



Chronic Regional
Pain Syndrome

Refractory Hypoglycaemia
in a 45-year-old Lady
with Malignant Peritoneal
Mesothelioma

Fasted, Not Parched:
An Update on Pre-operative
Liquid Fasting

Obturator Hernias

Pulmonary Embolism
Mimicking
Congestive Heart Failure

DermaVenFest 2025



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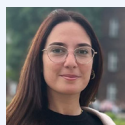
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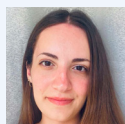


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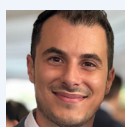
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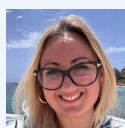
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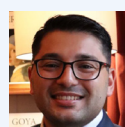
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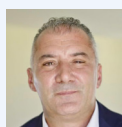
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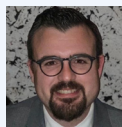
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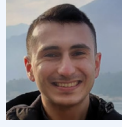
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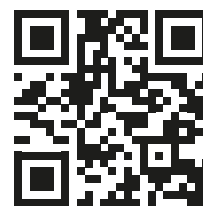
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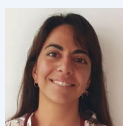


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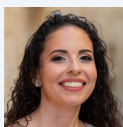
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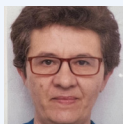
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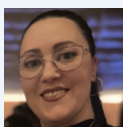
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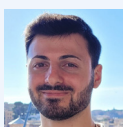
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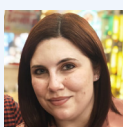
Dr Doreen Pace MD MSc has been working in oncology and palliative care since 1990. As a founder of inpatient Palliative Care in Malta, she is happy to see an emerging team of respectful, united, hardworking palliative care specialists in the making.



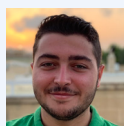
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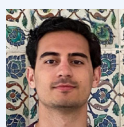
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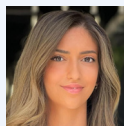
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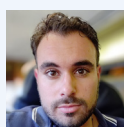
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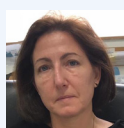
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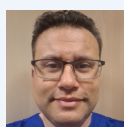
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Back to the 80s? The Law of Unintended Consequences

My childhood in the eighties revolved around family, school, lessons at The Society of Christian Doctrine (MUSEUM), watching Kenshiro manga series and Lupin, swapping Panini football stickers, and football matches. I inevitably grew up within a social fabric which no longer exists, with idealistic galvanised values which have somewhat gone brittle along the way and a fierce appetite for social justice, which still persists. So much so, I co-founded a Youth Centre which is still running efficiently after 22 years. Why am I walking down the memory lane?

I cherish the gift of time, good health and people who are in good faith. I equally loathe suffering and honey & milk shortbread biscuits offered by people who are in bad faith. I empathise deeply with the vulnerable and sick especially those of a young age. Today I realise that sickness is essentially a roll of dice. Religion and faith have nothing to do with sickness [with some exceptions] but they may offer some degree of solace to many. Although I am a conservative person, I understand that society needs to progress to cater for different pockets of society which are facing inherent difficulties. However, I am equally aware of the slippery slopes, intentional or otherwise, which have sprouted and will inevitably continue to appear on our children's horizons because of socio-economic progress. Here, the Law of Unintended Consequences may apply.

I am in favour of IVF and will use it as an example. As of 2025, according to the UK fertility regulator (The Human Fertilisation and Embryology Authority) pre-implantation genetic testing (PGD) for monogenic disorders can be used to discard embryos affected by over 1,700 genetic conditions, including deafness. The UK also offers Pre-implantation Tissue-Typing or 'saviour siblings' technology. Parents can choose to have a child and use this technology to selectively chose embryos that are an exact tissue match to their older sibling who has a life-limiting blood disorder.

Of note is the fact that PGD was initially used in the UK in 1990 to prevent a handful of genetic conditions such as muscular dystrophy. The natural PGD evolution from around 5 to 1,700 genetic conditions (and counting) serves to illustrate that once a law is introduced with varying degrees of resistance, that law can be changed in due course with much less effort. In Malta to date PGD covers 9 monogenic disorders i.e. Finnish Nephrotic Syndrome, Gangliosidosis, Huntington's Disease, Joubert Syndrome, Maple Syrup Urine Syndrome, Nemaline Myopathy, Spinal Muscular Atrophy, Tay-Sachs Disease and Walker-Warburg Syndrome. In the forthcoming years, we will also see a similar expansion [albeit to a smaller degree] to this list.

Here I will not discuss abortion. I do not judge those who do it. But I oppose it. Please do not let us argue that we need to

widen PGT testing to avoid the introduction of abortion. The ceremonious introduction of abortion in Malta, sadly, forms part of the ineluctable tide of history.

At this stage, I will however touch briefly on the proposed introduction of euthanasia in Malta which, I envisage, will be included in the forthcoming electoral manifesto. I comprehend the logic behind it. My father had pancreatic adenocarcinoma. Period. Are all patients like my father? No. Do I agree with euthanasia? No. Again, do I judge those who want to use it? No.

Euthanasia constitutes a balancing act between moral and empiric imperatives. Can we discuss euthanasia when there is no community-based palliative care with 24/7 availability? Can we speak of euthanasia when on the one hand the state goes to great lengths to appear secular but on the other hand, depends on the church? The only hospice centre was made possible solely through the intervention of Archbishop Charles J. Scicluna. The Church handed Adelaide Cini Institute, valued at €8 million, to Hospice Malta for the establishment of St Michael Hospice. The government supported its refurbishment through a social grant. Here I salute Hospice Malta for their unwavering commitment to life.

As a parent, I worry about the ramified slippery slopes which my children will face if euthanasia is introduced. Currently, it is being proposed to apply for individuals ≥ 18 years with a terminal physical illness who have a 'calculated' life expectancy of 6 months.

Taking Canada as an example, euthanasia was introduced in 2016, initially for the terminally ill. This was amended in 2021 and extended to those experiencing 'unbearable suffering' from an irreversible illness or disability. Further extension to those who have a mental illness is being discussed. In keeping with this, Belgium and Netherlands also consider patients with unbearable suffering from mental illness as eligible for euthanasia. In specific countries, euthanasia has been extended to minors.

Malta did the Litmus test various times. Catholic Malta will arrive there sooner than you expect ... I'm afraid that there will be no Goldilocks principle ...

My advice to my children?

"Trust your gut feelings which have been moulded through osmosis by those principles which you see me practice ... beneficence, nonmaleficence, autonomy, and justice. Be a catalyst for change but never compromise your values. Respect life. Respect the patient."

Ian Ellul

Fasted, Not Parched: An Update on Pre-operative Liquid Fasting

ABSTRACT

Pre-operative fasting is essential in decreasing the risk of aspiration of gastric contents during sedation or general anaesthesia. However, there is an increasing body of evidence that prolonged liquid fasting has harms of its own and confers no appreciable benefit when compared to more liberal liquid fasting strategies. In anticipation of the new adult peri-operative fasting guideline from the European Society of Anaesthesia & Intensive Care, expected in Q1 of 2025, we explore the historical context of "Nil by mouth from midnight" as well as recent updates on pre-operative liquid fasting and gastric physiology.

KEYWORDS

Peri-operative medicine, Fasting, Liquid Fasting, Pulmonary Aspiration, Nil by mouth

INTRODUCTION

In Q1 of 2025, the European Society of Anaesthesia & Intensive Care (ESAIC) will release an updated guideline on peri-operative fasting in adults.¹ In the context of this new guideline, we are providing a summary of the recent developments in the world of peri-operative fasting to help educate the local medical community and encourage them to read this new guideline when it is published.

The risk of aspiration of gastric contents into the lungs during induction or emergence of anaesthesia has long been acknowledged. It was initially and most prominently described in a retrospective study by the American obstetrician Curtis L Mendelson in 1946, who described 66 cases of aspiration of gastric contents during obstetric anaesthesia in 44,016 women. He termed this "Mendelson Syndrome". Mendelson went on to recommend pre-operative fasting, making no distinction between liquids and solids.² Together with this study and other studies which falsely suggested that the risk of pulmonary aspiration increased when a gastric

volume of 0.4ml/kg was present^{3,4} (a gastric volume present in 40-80% of healthy patients fasting for at least 8 hours³), the concept of nil by mouth (NBM) from midnight for elective surgery became standard.

More recent studies have highlighted that liquids and solids have different gastric emptying times.⁵ ESAIC's 2011 guidelines suggest that patients should drink clear fluids up to 2 hours before elective surgery, while fasting for solids should be 6 hours before surgery.⁶

REVIEW OF LOCAL PRACTICES

The local guidelines at Mater Dei Hospital (MDH), last updated in 2009, recommend that morning elective patients can drink water until 5:30 a.m.⁷ Despite these guidelines being over 10 years old, adherence has been lacking. In June 2024, we carried out a cross-sectional study in the main operating theatres at Mater Dei Hospital asking 61 adult patients undergoing elective surgery their liquid and solid fasting times. Patients were randomly chosen from operating theatre holding bays in Mater Dei Hospital over a single day. Their average fluid fasting time was 10.7 hours and the average solids fasting time was 16.7 hours. This is unsurprising given that most patients locally are still given the advice of "NBM from midnight". Of note is the fact that the majority of elective surgical lists at Mater Dei Hospital start at 8:30 a.m.

One of the main concerns of ESAIC's upcoming peri-operative fasting guideline is the potential for harm from prolonged liquid fasting. Apart from the easily anticipated increase in patient distress and thirst from prolonged liquid fasting, there is an increasing body of evidence of other harms.⁵ Patients undergoing prolonged liquid fasting (more than 2 hours) are more likely to experience worse peri-operative glycaemic control, increased post-operative nausea and vomiting, and higher rates of post-operative delirium.⁸ One study showed that dehydrated elderly patients undergoing hip fracture surgery had an almost four times higher rate of pulmonary and cardiovascular complications than

PATIENTS UNDERGOING PROLONGED LIQUID FASTING (MORE THAN 2 HOURS) ARE MORE LIKELY TO EXPERIENCE WORSE PERI-OPERATIVE GLYCAEMIC CONTROL, INCREASED POST-OPERATIVE NAUSEA AND VOMITING, AND HIGHER RATES OF POST-OPERATIVE DELIRIUM

their euvolemic counterparts.⁹ There are various studies comparing prolonged liquid fasting (more than 2 hours) with oral carbohydrate loading with up to 400 ml of a low-calorie clear fluid at 2 hours before surgery. These studies have shown that prolonged liquid fasting confers no improvement in gastric emptying or in decreasing gastric volumes.^{5,10,11} Furthermore, prolonged liquid fasting groups have shown, to varying degrees, an increased insulin resistance, increased inflammatory markers, worse post-operative cardiac function, longer hospital stay, and increased patient discomfort.^{5,10-12}

Clear fluids pass quickly through the stomach. After consuming 500ml of water, the stomach is typically empty within 20 minutes.^{5,13} Low-calorie clear fluids (30kcal/100ml) (which may serve as a pre-operative oral carbohydrate load) take slightly longer, with a 600ml bolus leaving the stomach in 30-40 minutes.¹⁴ Even in patients with risk factors for delayed gastric emptying (gastroparesis or those on drugs like GLP-1 agonists such as semaglutide), gastric emptying of clear fluids (but not solids) remains rapid, similar to healthy individuals.⁵

Previously, a gastric volume of 0.4ml/kg was thought to increase the risk of pulmonary aspiration, but more recent studies suggest a cut-off volume of 1.5ml/kg.¹⁵ This value still falls on the upper end of normal gastric volumes in healthy fasted patients. There is no definitive evidence of the gastric volume required to increase the risk of aspiration in humans;¹⁵ studies here would be impossible due to ethical concerns. Animal studies suggest the risk may rise at much higher gastric volumes (8ml/kg), making the 1.5ml/kg threshold a conservative estimate.^{5,15}

So what are the new ESAIC guidelines likely to suggest? The preliminary recommendations were presented during the Euroanaesthesia congress in Munich in June 2024 and stated that:

- Preoperative fasting for clear fluids should be approximately 2 hours - fasting for more than 2 hours may be harmful and should be avoided
- Patients should be encouraged to consume carbohydrate-containing clear liquids until approximately 2 hours before the procedure
- Patients who have eaten heavy meals rich in fat and protein need to fast for 8 hours, not 6 hours

- Clinicians may consider not postponing or cancelling a procedure based solely on the intake of clear liquids less than 2 hours preoperatively
- Postoperative liquids and diet should be resumed as soon as clinically feasible after the procedure, unless specifically contraindicated
- Need for better education on the harms of prolonged liquid fasting
- Implementation of systems to reduce fasting times in hospitals.

While reducing fasting times is a challenging issue due to the complexity of hospital peri-operative systems, there are solutions. For example, updating the local guidelines at MDH, adhering to surgical schedules, and splitting patients into morning and afternoon groups to allow for light meals could help.

Stakeholders, including medical staff, nurses, GPs, and patients, must be educated and coordinated. Some centres in the United Kingdom & Ireland use "sip-till-send" policies,¹⁶ allowing patients to drink water until they go to surgery, which could be beneficial.

CONCLUSION

Although the local guidelines at MDH recommend that morning elective patients can drink water until 5:30 a.m., current practices, usually revolving around 'NBM from midnight' are too conservative. They are leading to patients undergoing prolonged liquid fasting and may be harmful.

Further work is being done locally and on a European level to tackle the issue of prolonged pre-operative liquid fasting. MDH is leading an international cross-sectional study on pre-operative liquid fasting times, and the release of new ESAIC guidelines will be followed by an educational campaign. On the 21st and 22nd of February 2025, the Association of Anaesthesiologists of Malta will be hosting an international conference titled "Focus on the High-Risk Patient: Anaesthetic, Intensive Care and Pain Perspectives". Professor Frederico Bilotta, the head of the ESAIC taskforce on perioperative fasting in adults, and Dr Anne Marie Camilleri Podesta, a local anaesthesia consultant who is a member of the same task force, will be presenting the newly published perioperative fasting guidelines.

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COMPETING INTERESTS & FUNDING STATEMENTS

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Dr Anne Marie Camilleri Podesta is one of the authors of the upcoming European Society of Anaesthesia & Intensive Care guideline for peri-operative fasting in adults.

No other competing interests are declared.

REFERENCES

1. News from the ESAIC Guideline Task Force on Perioperative Fasting in Adults. ESAIC. 2024 [cited 2024 Oct 21]. Available from: <https://esaic.org/news-from-the-esaic-guideline-task-force-on-perioperative-fasting-in-adults/>
2. Mendelson CL. The Aspiration of Stomach Contents into the Lungs During Obstetric Anesthesia. *Anesthesiology* 1946;7(6):694–5.
3. Maltby JR. Fasting from midnight – the history behind the dogma. *Best Pract Res Clin Anaesthesiol* 2006;20(3):363–78.
4. Roberts RB, Shirley MA. Reducing the Risk of Acid Aspiration During Cesarean Section. *Anesth Analg* 1974;53(6):859.
5. Rüggeberg A, Meybohm P, Nickel EA. Preoperative fasting and the risk of pulmonary aspiration - a narrative review of historical concepts, physiological effects, and new perspectives. *BJA Open* 2024;10:100282.
6. Smith I, Kranke P, Murat I, et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. *Eur J Anaesthesiol* 2011;28(8):556.
7. Department of Anaesthesia, Intensive Care & Pain Medicine. Guidelines for Pre-Operative Fasting (ACC/01Guide/2009v01.0). Mater Dei Hospital. 2009 [cited 2024 Oct 21]. Available from: <https://govmt.sharepoint.com/sites/cpgmdh/Shared%20Documents/Forms/AllItems.aspx?id=%2Fsites%2Fcpghmdh%2FShared%20Documents%2FAnaesthesia%2FGuidelines%2Facc01guide2009v01%2E0%5FPre%20Op%20fasting%2Epdf&parent=%2Fsites%2Fcpghmdh%2FShared%20Documents%2FAnaesthesia%2FGuidelines>
8. Radtke FM, Franck M, MacGuill M, et al. Duration of fluid fasting and choice of analgesic are modifiable factors for early postoperative delirium. *Eur J Anaesthesiol* 2010;27(5):411–6.
9. Ylinenvaara S, Elisson O, Berg K, Zdolsek J, Krook H, Hahn R. Preoperative urine-specific gravity and the incidence of complications after hip fracture surgery: A prospective, observational study. *Eur J Anaesthesiol* 2013;31.
10. Kaška M, Grosmanová T, Havel E, et al. The impact and safety of preoperative oral or intravenous carbohydrate administration versus fasting in colorectal surgery – a randomized controlled trial. *Wien Klin Wochenschr* 2010;122(1):23–30.
11. Rizvanović N, Nesek Adam V, Čaušević S, et al. A randomised controlled study of preoperative oral carbohydrate loading versus fasting in patients undergoing colorectal surgery. *Int J Colorectal Dis* 2019;34(9):1551–61.
12. Cheng PL, Loh EW, Chen JT, et al. Effects of preoperative oral carbohydrate on postoperative discomfort in patients undergoing elective surgery: a meta-analysis of randomized controlled trials. *Langenbecks Arch Surg* 2021;406(4):993–1005.
13. Okabe T, Terashima H, Sakamoto A. Determinants of liquid gastric emptying: comparisons between milk and isocalorically adjusted clear fluids. *Br J Anaesth* 2015;114(1):77–82.
14. Leiper JB. Fate of ingested fluids: factors affecting gastric emptying and intestinal absorption of beverages in humans. *Nutr Rev* 2015;73(suppl_2):57–72.
15. Van de Putte P, Perlas A. The link between gastric volume and aspiration risk. In search of the Holy Grail? *Anaesthesia* 2018;73(3):274–9.
16. Curran CS, Betts A, Featherstone M, et al. Implementing a 'Sip Til Send' policy at a large tertiary referral centre: a quality improvement project. *BJA Open* 2024;12:100331.

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Pulmonary Embolism Mimicking Congestive Heart Failure

ABSTRACT

Pulmonary embolism is a life-threatening condition that can present with a wide range of non-specific symptoms, often overlapping with cardiovascular diseases. Here, we report a case of an 83-year-old female with a history of hypertension, rheumatoid arthritis and mild heart failure presenting with signs and symptoms initially suggestive of acute decompensated heart failure. Further diagnostic workup revealed that the true underlying pathology was a bilateral submassive pulmonary embolism. This case highlights the diagnostic challenges and importance of considering pulmonary embolism in patients with seemingly classic signs of congestive heart failure.

KEYWORDS

Pulmonary embolism, Congestive heart failure, Diagnostic challenges, POC echo.

INTRODUCTION

Pulmonary embolism (PE) is caused by the obstruction of the pulmonary arteries, usually by a thrombus originating from the deep veins of the legs.¹ It can present with non-specific symptoms, often mimicking other cardiopulmonary conditions such as congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD).^{2,3} Distinguishing between PE and CHF is crucial, as both require distinct management approaches but may present similarly, especially in elderly patients with co-morbidities.⁴

CASE PRESENTATION

HISTORY AND PRESENTATION

An 83-year-old female presented to the emergency department (ED) in August 2024 with complaints of progressive shortness of breath and fatigue for five days. Relatives reported a gradual worsening of dyspnea, particularly on exertion, along with orthopnea and paroxysmal nocturnal dyspnea. The patient weighed 80 kg and had a history of hypertension; previous

echocardiograms showed left diastolic dysfunction. Her last NT-proBNP taken in April 2024 was 222 pg/mL. She was on multiple medications including doxazosin 1 mg BD, candesartan 16 mg daily, bumetanide 1 mg daily, aspirin 75 mg daily, tramadol 50 mg x 6 daily and prednisolone 15 mg daily (the latter two for control of her rheumatoid arthritis).

Upon physical examination, the patient appeared dyspneic but was alert and oriented. Vital signs revealed:

- Heart rate: 73 beats per minute
- Blood pressure: 100/53 mmHg
- Respiratory rate: 32 breaths per minute
- Oxygen saturation: 80% on room air
- Jugular venous distention (JVD) was present, however pitting oedema of lower limbs was minimal. Facial oedema was pronounced; deemed secondary to the patient's intermittent use of 15 mg of prednisolone daily for 5 years.

Lung auscultation revealed crepitations at the lung bases bilaterally, and heart sounds were normal. Given her history and these findings, a provisional initial diagnosis of acute decompensated heart failure was made.

INITIAL INVESTIGATIONS

- Electrocardiogram (ECG): Tall R waves consistent with left ventricular hypertrophy and a right bundle branch block was present. These findings were also presented in previous ECGs.
- Chest X-ray: Cardiomegaly was visible, as well as bilateral increased interstitial lung markings in keeping with pulmonary congestion. There was no pneumothorax but there was a small left-sided pleural effusion.
- Lab tests
 - Elevated NT-proBNP: 3852 pg/mL (N: ≤ 150 pg/mL).
 - Troponin I: 88.20 pg/mL (N: ≤ 47.8 pg/mL).
 - White cell count: $14.14 \times 10^9/L$ (N: $4.3 - 11.4 \times 10^9/L$).
 - C-reactive protein: 62 (N: 0-5 mg/L).

INITIAL MANAGEMENT

The patient was treated with oxygen therapy, with SpO₂ improving to 93%. In view of the borderline hypotension, diuretics were initially withheld, and a point of care (POC) echocardiogram was requested for further assessment.

DIAGNOSTIC DILEMMA

For assurance of diagnosis of CHF exacerbation, a POC echocardiogram was performed. This revealed a grossly normal left ventricular function with right ventricular dilatation - RV/LV diameter ratio ≥ 1.0 . There was impaired right ventricular systolic function of the RV free wall with right apical hypercontractility (McConnell's sign).^{5,6} The inferior vena cava (IVC) was plethoric ($>2\text{cm}$) with poor collapse on inspiration ($<50\%$ collapsibility).

These findings, along with the significantly reduced oxygen saturations on room air, raised the suspicion of a PE.⁵⁻⁷

A CT pulmonary angiogram (CTPA) was therefore performed, which revealed dilation of the pulmonary main trunk, measuring 3.2 cm, as well as bilateral pulmonary emboli in the distal main, segmental, and sub-segmental arteries. These findings were consistent with the diagnosis of a submassive PE.^{7,8}

DISCUSSION

This case underscores the diagnostic challenges posed by PE, particularly when it mimics CHF. Both conditions can present with dyspnea, peripheral oedema, elevated BNP, and jugular venous distention, making initial differentiation difficult.^{3,9} Key distinguishing features that raised suspicion for PE in this case were:

- Significantly low oxygen saturations on room air: The patient's clinical presentation was not consistent with significant fluid overload as the underlying cause for this degree of hypoxia.⁹
- Response to oxygen therapy: The patient demonstrated a positive response to oxygen therapy without the administration of diuretics.^{10,11}
- Echocardiographic findings: The presence of right ventricular dilatation and McConnell's sign indicated acute right ventricular strain, indicating the possibility of a PE.^{5,6}

CHF and PE share several overlapping features, especially in patients with a history of heart failure or other co-morbidities. Both conditions may result in increased pulmonary pressures, leading to right heart strain. The elevated NT-proBNP in this patient initially pointed towards CHF, but an elevated NT-proBNP can also occur in PE due to right ventricular strain.^{3,9}

In this case, the misdiagnosis of CHF could have led to inappropriate management with diuretics alone, delaying the administration of life-saving anticoagulation or thrombolysis.¹² Given the large clot burden, prompt initiation of anticoagulation therapy with enoxaparin 80mg BD was critical to prevent further complications such as hemodynamic collapse or right heart failure.¹³ Aspirin was discontinued, however the rest of her medications remained unchanged when she was admitted from A&E.

Thrombolysis in PE is primarily indicated for patients at high risk of mortality or hemodynamic collapse. This includes those with massive PE, characterized by hemodynamic instability such as sustained hypotension (systolic blood pressure < 90 mmHg for more than 15 minutes) or cardiogenic shock. In these cases, thrombolysis is crucial to rapidly dissolve the clot, restore pulmonary circulation, and prevent right ventricular failure and death.^{1,10} Thrombolytic therapy is most commonly administered using agents like alteplase (tPA).³ For patients with submassive PE - those with right ventricular dysfunction or myocardial injury but without hypotension - thrombolysis can be considered if there is evidence of clinical deterioration, such as worsening hypoxia, respiratory distress, or progressive right ventricular dysfunction.¹⁴ However, its use in these cases is more controversial due to the increased risk of bleeding, and the decision must be based on a careful risk-benefit assessment.¹⁵ Contraindications to thrombolysis include factors such as a history of hemorrhagic stroke, active bleeding, or recent major surgery, all of which increase the risk of serious bleeding complications.^{16,17} In situations where PE causes cardiac arrest, thrombolysis may also be considered as part of resuscitation efforts.¹⁸ Ultimately, thrombolysis should be used when the potential benefits outweigh the risks, particularly in life-threatening cases of PE.¹⁹

In this case, the patient remained hemodynamically stable, demonstrated a positive response to oxygen therapy, and exhibited no signs of clinical deterioration. As a result, treatment with low molecular weight heparin was considered the more appropriate therapeutic option.¹¹

MANAGEMENT AND OUTCOME

After the diagnosis of a submassive PE, the patient was immediately started on low molecular weight heparin and was admitted on a monitored bed. Her clinical condition stabilised over the next 48 hours, with respiratory rate improving from 32 breaths/minute at initial presentation to 20 breaths/min. Oxygen saturations also stabilised to 94-96% on room air, even after mobilisation.

During admission, the patient underwent physiotherapy and occupational therapy to improve mobility and quality of life. Her treatment was also adjusted with bumetanide increased to 1 mg 1-1-0, candesartan decreased to 8 mg daily and tramadol decreased to 50 mg 1-1-2 (the latter was adjusted to decrease events of low respiratory drive). The patient was investigated for a potential trigger for a pulmonary embolus with an abdominal ultrasound and tumour markers all of which were clear.

The patient was discharged after 18 days and prescribed rivaroxaban 15 mg for a total of 21 days, which was then to be increased to 20 mg daily for 6 months, with close follow-up. A CT abdomen pelvis was done later which also excluded malignancy as a trigger for the pulmonary emboli. The patient continued to be followed up and investigated as an outpatient.

CONCLUSION

PE can closely mimic CHF, particularly in patients with pre-existing cardiovascular disease. This case highlights the importance of considering PE in the differential diagnosis of dyspnea and signs of heart failure, especially when the clinical response to standard heart failure treatment is suboptimal.²⁰ It also underscores the utility of POC echocardiography in distinguishing between PE and CHF.⁵ Early diagnosis and management of PE are critical in preventing potentially fatal outcomes.¹¹

KEY LEARNING POINTS

1. PE should be considered in patients presenting with signs and symptoms of CHF, particularly if there are significantly low oxygen saturations and/or an inadequate response to diuretic therapy which are not consistent with significant fluid overload.
2. Elevated NT-proBNP and troponin may be present in both PE and CHF due to right heart strain.
3. Right ventricular dysfunction on echocardiography should raise suspicion for PE, especially if left ventricular function is preserved or only mildly reduced.
4. POC echo has a role in differentiating between PE and CHF.
5. Prompt imaging, such as CTPA, is crucial for the definitive diagnosis of PE.

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COMPETING INTERESTS

None declared.

PATIENT CONSENT FOR PUBLICATION

Consent obtained directly from patient.

REFERENCES

- 1 Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *European Heart Journal* 2020;41(4):543–603.
- 2 Piazza G, Goldhaber S Z. Pulmonary embolism in heart failure. *Circulation* 2008;118(15):1598–1601.
- 3 Goldhaber SZ, Morrison RB. Cardiology patient pages. Pulmonary embolism and deep vein thrombosis. *Circulation* 2002;106(12):1436–8.
- 4 Miniati M, Cenci C, Monti S, et al. Clinical presentation of acute pulmonary embolism: survey of 800 cases. *PloS one* 2012;7(2):e30891.
- 5 McConnell MV, Solomon SD, Rayan ME, et al. Regional right ventricular dysfunction detected by echocardiography in acute pulmonary embolism. *The American Journal of Cardiology* 1996;78(4):469–73.
- 6 Rudski LG, Lai WW, Afilalo J, et al. Guidelines for the echocardiographic assessment of the right heart in adults: a report from the American Society of Echocardiography endorsed by the European Association of Echocardiography, a registered branch of the European Society of Cardiology, and the Canadian Society of Echocardiography. *J Am Soc Echocardiogr* 2010;23(7):685–713.
- 7 Kim HY, Kim KH, Kim J, et al. Multimodality cardiovascular imaging in pulmonary embolism. *Cardiology Journal* 2021;28(1):150–60.
- 8 Stein PD, Beemath A, Matta F, et al. Clinical characteristics of patients with acute pulmonary embolism: data from PIONEER II. *The American journal of medicine* 2007;120(10): 871–9.
- 9 McCullough PA, Nowak RM, McCord J, et al. B-type natriuretic peptide and clinical judgment in emergency diagnosis of heart failure: Analysis from Breathing Not Properly (BNP) Multinational Study. *Circulation* 2002;106(4):416–422.
- 10 Kucher N, Goldhaber SZ. Management of massive pulmonary embolism. *Circulation* 2005;112(2):e28–e32.
- 11 Aronow WS, Rich MW, Fleg JL (Eds). *Cardiovascular Disease In The Elderly, Revised And Expanded (3rd ed.)* CRC Press. US. 2004.
- 12 Zondag W, Mos ICM, Creemers-Schild D, et al. Outpatient treatment in patients with acute pulmonary embolism: The Hestia Study. *Journal of Thrombosis and Haemostasis* 2011;9(8):1500–7.
- 13 Grifoni S, Olivetto I, Cecchini P, et al. Short-term clinical outcome of patients with acute pulmonary embolism, normal blood pressure, and echocardiographic right ventricular dysfunction. *Circulation* 2000;101(24):2817–22.
- 14 Jaff MR, McMurry MS, Archer SL, et al. Management of massive and submassive pulmonary embolism, iliofemoral deep vein thrombosis, and chronic thromboembolic pulmonary hypertension: A scientific statement from the American Heart Association. *Circulation* 2011;123(16):1788–830.
- 15 Meyer G, Vicaut E, Danays T, et al. Fibrinolysis for patients with intermediate-risk pulmonary embolism. *New England Journal of Medicine* 2014;370(15):1402–11.
- 16 Guyatt GH, Akl EA, Crowther M, et al. Executive summary: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest* 2012;141(2 Suppl):7S–47S.
- 17 Piazza G, Goldhaber SZ. Management of submassive pulmonary embolism. *Circulation* 2010;122(11):1124–9.
- 18 Feltes J, Popova M, Hussein Y, et al. Thrombolytics in cardiac arrest from pulmonary embolism: A systematic review and meta-analysis. *Journal of Intensive Care Medicine* 2024;39(5):477–483.
- 19 Sharifi M, Bay C, Skrocki L, et al. Moderate pulmonary embolism treated with thrombolysis (from the “MOPETT” Trial). *The American journal of cardiology* 2013;111(2):273–277.
- 20 Miniati M, Monti S, Bottai M, et al. Survival and restoration of pulmonary perfusion in a long-term follow-up of patients after acute pulmonary embolism. *Medicine* 2006;85(5):253–262.

Obturator Hernias

ABSTRACT

Obturator hernias are an uncommon type of abdominal hernia, occurring at the pelvic floor. Clinical presentation is vague with symptoms including nausea and vomiting secondary to intestinal obstruction as well as inner thigh pain which can be clinically exacerbated by hip and knee flexion (Howship-Romberg sign). Imaging modalities such as computed tomography and ultrasound allow visualisation of the herniated tissue within the obturator foramen. Surgical reduction of the herniated contents is the standard intervention and can be performed via open or laparoscopic techniques.

KEYWORDS

Obturator hernia, Abdominal hernia, Hernia surgery, Intestinal obstruction.

AETIOLOGY AND INCIDENCE

Due to their rarity and subtle onset, obturator hernias offer a diagnostic dilemma in clinical practice, with only 1 in 10 cases being correctly diagnosed pre-operatively.¹ Owing to the frequently delayed recognition and the high incidence of patients with concurrent medical comorbidities,² morbidity and mortality rates stand at around 38% and 12–70% respectively.³

The incidence of obturator hernias is <1% of all abdominal wall hernias.³ Characterised by the protrusion of small bowel and less commonly pelvic adnexa, appendix, omentum or colon into the obturator foramen, a right-sided obturator hernia is more common, with a ratio of 2:1, since the sigmoid colon acts as a protective barrier at the left obturator foramen.⁴ Bilateral herniation,⁵ as well as concurrence with other hernias, most frequently femoral,⁶ has been reported. The female to male ratio varies between 9 and 6:1 attributed to a broader pelvis resulting in a larger triangular obturator foramen with a greater transverse diameter. Obturator hernias are typically seen in frail, elderly women (85%), often institutionalised and chronically ill, with a mean age of 82 years and mean weight of 34.5 kg.⁷ This predominance in elderly females has led to the derivation of the moniker “little old ladies’ hernia”.⁶ There is also a higher incidence of obturator hernias in Asian populations, with the typical thin body habitus being postulated as a cause.⁸

Other contributing factors include multiparity, weight loss and malnutrition, and comorbidities causing raised intra-abdominal pressure such as chronic obstructive pulmonary disease, ascites, and chronic constipation.⁵

CLINICAL PRESENTATION

Clinical presentation is insidious. 90% of patients present with acute mechanical small bowel obstruction, having dull spasmodic abdominal pain, nausea, and vomiting. Patients may also present with chronic refractory groin pain or cramps or hyper/hypoesthesia along the medial aspect of the thigh due to obturator nerve compression. The Howship-Romberg sign can be elicited in around 50% of patients⁹ when neuralgic pain is exacerbated during extension, abduction, and medial rotation of the thigh, and relieved during flexion of the thigh. Rarely, the patient may complain of a mass over the medial thigh or complain of lower urinary tract symptoms if the bladder forms part of the hernia content.¹⁰

The Hannington-Kiff sign is more specific but occurs less frequently than the Howship-Romberg sign, and is characterised by the loss of the thigh adductor reflex in the presence of a normal ipsilateral patellar tendon reflex.¹¹

DIFFERENTIAL DIAGNOSIS

Differential diagnosis includes femoral hernia, pelvic tumours, hypogastric artery aneurysms, endometriosis, retroperitoneal haematomas, musculoskeletal and soft tissue pathologies, as well as intestinal obstruction causes.^{12–15}

INVESTIGATIONS

Computed tomography (CT) of the abdomen and pelvis is the gold standard diagnostic tool, boosting the preoperative diagnosis rate to around 90%. A CT scan can accurately demonstrate a low-density mass such as a fluid-filled or an air-filled bowel loop, in the area of the obturator foramen, between the obturator externus and the pectineus muscles, as well as indicate any features of intestinal obstruction.³ An ultrasound (US) scan offers a rapid, non-invasive, and cheap diagnostic alternative which may be used in an emergency situation. Magnetic resonance imaging (MRI) has also been used and is comparable to CT scans.¹⁶

TREATMENT

The diagnosis of an obturator hernia tends to necessitate immediate surgical release and repair of the hernial defect to avoid strangulation.¹⁷⁻¹⁸ Surgical approaches include intra-abdominal (transperitoneal), extraperitoneal, and laparoscopic.¹⁹ An extraperitoneal approach is considered superior in established pre-operatively diagnosed cases since there is less risk of future adhesions.¹⁷ An intra-abdominal approach is best considered in emergency situations, when strangulation is suspected or when diagnosis is unclear, due to improved surgical field exposure and easier hernia reduction and repair of the defect.^{17,20-21} Gentle dorsal and medial traction should be applied intra-operatively, with utmost care during reduction, to prevent rupture of the already oedematous bowel.^{20,22} Meticulous assessment of the intestinal loop must be done, to ascertain bowel viability and determine whether bowel resection and primary anastomosis should be performed.²² Sac excision and repair of the defect with sutures or a prosthetic patch further lowers recurrence rates.³ Use of prosthetic materials, such as a polypropylene mesh, is favoured for larger defects.²³

It is advisable to check and prophylactically reinforce the contralateral obturator canal during the index operation due to the high incidence of recurrences, bilaterality, and difficulty with clinical diagnosis, even when only a unilateral hernia is evident.^{1,24}

The laparoscopic approach offers fewer post-operative complications,¹¹ including shorter hospital stays and lower rates of postoperative ileus and postoperative pain.⁸

COMPLICATIONS

If left untreated, complications include colocutaneous fistulae,²⁵ bowel perforation secondary to gangrene, peritonitis, septicaemia, and ultimately death.²⁶ Such fatal complications are not uncommon and are the result of a delay in diagnosis since obturator hernias are rare and may go undetected.^{3,26}

CASE REPORT

An 86-year-old Caucasian woman presented to the emergency department with a 4-day history of vomiting and a 5-day history of constipation. She reported having more than 5 episodes of vomiting per day, with the vomitus being described as darkish in colour. She also remarked that she was passing less flatus than usual, but was still passing urine normally.

The patient had a history of ischaemic heart disease, congestive heart failure, hypertension, hypothyroidism, and gastroesophageal reflux disease, but reported no surgical history. She was on aspirin 75 mg daily, bumetanide 1 mg twice daily, carvedilol 6.25 mg twice daily, omeprazole 20 mg daily, levothyroxine 100 mcg daily, and perindopril 4 mg daily. She was allergic to pregabalin. Socially, she lived independently within the community, coping with her Activities of Daily Living (ADLs) and does not smoke or drink alcohol.

On clinical examination, she was noted to be dehydrated, though alert and oriented, with a pulse of 88 bpm, blood pressure of 143/80 mmHg, SpO₂ of 99% and a temperature of 36.9°C. Heart sounds were normal, bibasal crepitations were detected on auscultation of the chest and there were no signs of oedema or deep vein thrombosis in the lower limbs. On abdominal examination, the abdomen was distended but soft with minimal discomfort on abdominal palpation.

An initial X-ray of the abdomen showed dilated loops of the small bowel. A subsequent CT scan showed small bowel obstruction secondary to a left obturator hernia containing a loop of ileum with no evidence of ischaemia or perforation on imaging.

The patient was kept nil by mouth, and a nasogastric tube and urinary catheter were inserted. She was also given IV fluid replacement and maintenance and input-output charting was started. She was taken to the operating theatre on the same day for a laparoscopic left obturator hernia repair.

A left-sided obturator hernia with an incarcerated loop of small bowel and contained perforation at the site of the hernia was noted intraoperatively.

DIFFERENTIAL DIAGNOSIS INCLUDES FEMORAL HERNIA, PELVIC TUMOURS, HYPOGASTRIC ARTERY ANEURYSMS, ENDOMETRIOSIS, RETROPERITONEAL HAEMATOMAS, MUSCULOSKELETAL AND SOFT TISSUE PATHOLOGIES, AS WELL AS INTESTINAL OBSTRUCTION CAUSES

The hernia was reduced laparoscopically. A washout was performed within the hernial sac and the defect was closed with a figure-of-8 suture using a PDS 2-0 suture. The segment of small bowel containing the perforation was delivered through an Alexis port that was placed through the extended infra-umbilical port incision. Both the resection and the side-to-side entero-enteric anastomosis (utilising a PDS 3-0 suture) were done extracorporeally. Post-operatively, the patient remained well and resumed her normal diet within a few days. She opened her bowels 5 days following the surgery and was deemed dischargeable on postoperative day 7. She was given co-amoxiclav 1 g twice daily, for a further 3 days. The patient was followed up at outpatients 4 weeks following surgery having recovered well and without concern.

CONCLUSION

Given the elusive nature of obturator hernias and the associated diagnostic challenges, it is imperative that clinicians maintain a heightened level of vigilance. Timely and accurate referral of patients presenting with symptoms indicative of obturator hernias is crucial, as it facilitates prompt intervention, thereby mitigating the associated morbidity and mortality risks.

REFERENCES

- 1 Bergstein JM, Condon RE. Obturator hernia: Current diagnosis and treatment. *Surgery* 1996;119(2):133–136.
- 2 Salameh JR. Primary and unusual abdominal wall hernias. *Surgical Clinics of North America* 2008;88(1):45–60.
- 3 Mandarri MT, Zeng SB, Wei ZQ, et al. Obturator hernia - a condition seldom thought of and hence seldom sought. *International Journal of Colorectal Disease* 2011;27(2):133–141.
- 4 Igari K, Ochiai T, Aihara A, et al. Clinical presentation of obturator hernia and review of the literature. *Hernia* 2010;14(4):409–413.
- 5 Rodríguez-Hermosa JI, Codina-Cazador A, Maroto-Genover A, et al. Obturator hernia: Clinical analysis of 16 cases and algorithm for its diagnosis and treatment. *Hernia* 2008;12(3):289–297.
- 6 Rajendran S, Murphy M, O'Hanlon D. Little old ladies' hernia: A clinical diagnostic conundrum. *BMJ Case Rep* 2009;bcr01.1470.
- 7 Yip AW, AhChong AK, Lam KH. Obturator hernia: a continuing diagnostic challenge. *Surgery* 1993;113(3):266–269.
- 8 Stamatiou D, Skandalakis LJ, Zoras O, et al. Obturator Hernia Revisited: Surgical Anatomy, Embryology, Diagnosis, and Technique of Repair. *The American Surgeon* 2011;77(9):1147–57.
- 9 Itani KMF, Zare SM. Uncommon Abdominal Wall Hernias. In: Bland KI, Büchler MW, Csendes A, et al. (eds) *General Surgery*. 2009. Springer, London.
- 10 Velásquez-López JG, Gil FG, Jaramillo FE. Laparoscopic repair of obturator bladder hernia: Case report and review of the literature. *Journal of Endourology* 2008;22(2):361–4.
- 11 Major CK, Aziz M, Collins J. Obturator hernia: a case report. *J Med Case Reports* 2021;15:319.
- 12 Modelli M, Giannini F, Guazzi G, ET AL. Obturator neuropathy due to obturator hernia. *Muscle & Nerve* 2002, 26(2), 291–2. <https://doi.org/10.1002/mus.10200>
- 13 Shankar H. Ultrasound-Guided Steroid Injection for Obturator Neuralgia. *Pain Practice* 2008;8(4):320–3.
- 14 Browne HN, Sherry R, Stratton P. Obturator hernia as a cause of recurrent pain in a patient with previously diagnosed endometriosis. *Fertility and Sterility* 2008;89(4):962–3.
- 15 Kumka M. Critical sites of entrapment of the posterior division of the obturator nerve: anatomical considerations. *The Journal of the Canadian Chiropractic Association* 2010;54(1):33–42.
- 16 Goh L, Chinchure D, Lim T. Clinics in Diagnostic Imaging (166). *Singapore Medical Journal* 2016;57(3):161–5.
- 17 Zhang H, Cong JC, Chen CS. Ileum perforation due to delayed operation in obturator hernia: a case report and review of literatures. *World journal of gastroenterology* 2010;16(1):126–30.
- 18 Chang S, Shan Y, Lin Y, et al. A Review of Obturator Hernia and a Proposed Algorithm for its Diagnosis and Treatment. *World Journal of Surgery* 2005;29(4):450–4.
- 19 Sá N, Silva V, Carreiro P, et al. Rare case of incarcerated obturator hernia: Case report and review of literature. *International Journal of Surgery Case Reports* 2017;37:157–60.
- 20 Marchal F, Parent S, Tortuyaux JM, et al. Obturator hernias - Report of seven cases. *Hernia* 1997;1(1):23–6.
- 21 Rizk TA, Deshmukh N. Obturator Hernia: A Difficult Diagnosis. *Southern Medical Journal* 1990;83(6):709–12.
- 22 Skandalakis LJ, Skandalakis PN, Colborn GL, et al. Obturator hernia: embryology, anatomy, surgery. *Hernia* 2000;4(2):121–8.
- 23 Lobo DN, Clarke DJ, Barlow AP. Obturator hernia: a new technique for repair. *Journal of the Royal College of Surgeons of Edinburgh* 1998;43(1):33–34.
- 24 Nakayama T, Kobayashi S, Shiraishi K, et al. Diagnosis and treatment of obturator hernia. *The Keio Journal of Medicine* 2002;51(3):129–132.
- 25 Riaz AA, Kumar SK, O'Reilly A, et al. A rare fistula: obturator hernia producing a colcutaneous fistula. *Eur J Surg*. 2001;167(12):924–6.
- 26 Jacob TJ, Gaikwad P, Tirkey AJ, et al. Perforated obturator Littre hernia. *Canadian journal of surgery*. *Can J Surg* 2009;52(3):E77–8.



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Refractory Hypoglycaemia in a 45-year-old Lady with Malignant Peritoneal Mesothelioma

KEYWORDS

Palliative care, Refractory hypoglycaemia, End-of-life care, Mesothelioma.

ABSTRACT

BACKGROUND

Non-islet tumour hypoglycaemia (NICTH) is an uncommon paraneoplastic syndrome characterized by refractory hypoglycaemia potentially impacting quality of life.

CASE PRESENTATION

A 45-year-old lady with peritoneal mesothelioma developed unexplained refractory hypoglycaemia. Investigations supported NICTH. A management plan respecting her preferences and autonomy was made: a combination of high-dose dexamethasone, encouraging oral intake and as-needed intravenous (IV) dextrose. This avoided symptomatic hypoglycaemic episodes.

CONCLUSION

We describe an uncommon clinical manifestation of malignant mesothelioma and a pathophysiology overview. We explore the importance of timely diagnosis and appropriate management of hypoglycaemia in keeping with patients' preferences and prioritising quality of life at end-of-life.

INTRODUCTION

Hypoglycaemia is a common medical emergency in diabetic patients. However, hypoglycaemia in nondiabetic patients with malignancy is not well-reported in the literature, despite reports of it dating back to 1929.¹

Hypoglycaemia in healthy individuals triggers counterregulatory, sympathetic and nervous system responses. 25-60% of palliative patients nearing the end-of-life, may lack such responses.²

Mechanisms for hypoglycaemia episodes in the palliative care population include malignancy-related increased metabolic stress and increased glucose utilisation, reduced endogenous glucose production via decreased oral intake and organ failure, defects in assimilation and cachexia, and impaired hepatic gluconeogenesis related to hepatic failure.² Multiorgan failure can also trigger endocrine organ dysfunction leading to hypoglycaemia.²

In NICTH, overproduction of insulin-like growth factor-2 (IGF-2) and its precursors activate the insulin receptor, resulting in hypoglycaemia.³ It is a rare condition with unknown true incidence but it is estimated to be one per million people years.³ Tumours associated with NICTH include hepatocellular carcinoma, fibrosarcoma, mesothelioma, adrenocortical carcinoma, hemangiopericytoma, stomach carcinoma, pancreatic carcinoma, medullary thyroid carcinoma, lymphoma, leukaemia, and carcinoid syndrome.^{4,5}

Treatment of NICTH-related hypoglycaemia in palliative care is challenging, and no formal guidance is available. A few case reports and series describe ways of managing this, summarised in Table 1.

This case report describes the clinical presentation of NICTH in a 45-year-old lady with advanced peritoneal malignancy. It focuses on the management of refractory hypoglycaemia, in an inpatient palliative care setting, using a shared decision-making approach. This case highlights the need to be aware of this uncommon paraneoplastic syndrome, as management can improve symptom control and end-of-life care.

**THE PATIENT WANTED
TO LIVE AS LONG AS
POSSIBLE, FOR HER TWO
YOUNG CHILDREN**

Table 1. Summary of available literature.

Title	Author	Type	Case/s	Main learning points
Management of Severe Hypoglycemia at the End of Life in Non-Diabetic Patients: A Case Study and Recommendations	Gonzalez et al., 2013	Case report	73-year-old, non-diabetic, presented with symptomatic hypoglycaemia and recurrent lung sarcoma.	Hypoglycaemia continued despite glucagon and dietary interventions. 4 mg once daily dexamethasone was used and patient died comfortably. Use of IV/PO glucose in the acute hypoglycaemic setting was recognised. ⁶
Refractory hypoglycaemia from paraneoplastic insulin-like growth factor 2 secretion in a patient with hepatocellular carcinoma	Behringer-Massera., 2017	Case report	22-year-old with metastatic hepatocellular carcinoma with persistent hypoglycaemia. Non-diabetic.	Despite high dose glucocorticoid therapy, hypoglycaemia continued requiring continuous IV dextrose (continued in hospice setting). They noted the ongoing need for IV dextrose may represent disease progression. They noted that extensive hepatic involvement may have exacerbated hypoglycaemia. ⁷
A case of non-islet cell tumor hypoglycemia associated with malignant mesothelioma requiring a multifaceted approach for optimal glycemic control	Ono et al., 2021	Case report	77-year-old Japanese man with mesothelioma and NICTH resulting in refractory hypoglycaemia. Patient had a history of well-controlled diabetes.	Chemotherapy and daily supplementation with hydrocortisone 40 mg daily prevented hypoglycaemia. When chemotherapy was stopped due to tumour progression, hypoglycaemic episodes were controlled by increasing steroid dose. Regular oral and IV glucose was also needed. This strategy helped keep the patient conscious until he died of respiratory failure. ⁸
Hypoglycemia as a Symptom of Neoplastic Disease, with a focus on Insulin-like Growth Factors Producing Tumors	Schovanek et al., 2019	Review article		The authors noted that acute treatment should involve glucose or glucagon. Overall management depends on tumour type and goal of care. Increasing oral glucose intake is effective but not a permanent solution and glucocorticoid therapy is effective. ⁴
Non-islet Cell Tumour Hypoglycaemia (NICTH) in Malignant Mesothelioma: Case Report	Wong et al., 2014	Case report	56-year-old non diabetic with unresectable malignant pleural mesothelioma.	A combination of dexamethasone and recombinant human growth hormone was used successfully to ameliorate the hypoglycaemic episodes. ⁹
Paraneoplastic hypoglycemia in a patient with a malignant solitary fibrous tumor	Mohammedi et al., 2014	Case report	77-year-old lady with a malignant solitary fibrous tumour.	They found that treatment with corticosteroids, growth hormone, or both can improve hypoglycaemic symptoms. ¹⁰
Nonislet Cell Tumor Hypoglycemia	Thomas and Kumar., 2013	Case report	63-year-old male, squamous cell carcinoma of the oesophagus, non-diabetic, with recurrent hypoglycaemia.	Hypoglycaemia continued despite continuous feed and resolved within a day of treatment with steroids. ¹¹
Non-islet Cell Hypoglycemia: Case Series and Review of the Literature	Garla et al., 2019	Case series, 2 cases	33-year-old male, liver tumour and NICTH.	Hypoglycaemia continued despite prednisolone treatment (max dose of 40 mg daily). Patient refused surgical excision. ⁵
			54-year-old with uterine tumour with NICTH.	Hypoglycaemia persisted despite IV dextrose 20% and resolved after surgical excision. ⁵

CASE PRESENTATION

A 45-year-old lady with peritoneal malignant mesothelioma presented to the emergency department with loss of consciousness. Blood glucose (BG) levels were 0.2 mmol/L (normal fasting BG: 3.8–6.1 mmol/L). Initial management included hourly BG checks and IV infusions of 10% dextrose. She regained consciousness but continued to have severe hypoglycaemic episodes, requiring glucose IV infusions in an acute medical ward. One week later, she was transferred to the palliative care unit (PCU) at SAMOC.

Seven months previously she had been diagnosed with malignant peritoneal mesothelioma. The outcome from a local multidisciplinary team meeting with a specialised centre in the United Kingdom confirmed epithelioid peritoneal mesothelioma, and treatment with Nivolumab/ipilimumab was commenced. A few months later oncological treatment was stopped due to poor response and deterioration in general condition.

Past medical history included an appendicectomy. She was not taking regular medications. She lived with her husband and two children (5 and 7 years old). She stopped smoking a few months prior to her admission, had no history of excess alcohol intake and worked at a grocery store.

She was cachectic and had ascites but had good oral intake. She spent over 50% of her waking time in bed and required support for most activities of daily living.

A full workup ruled out surreptitious use of hypoglycaemic agents and results in keeping with a diagnosis of NICTH as seen in Table 2.

NICTH was discussed with the patient and her husband. The potentially fatal outcome of severe hypoglycaemia and the irreversibility of this issue due to it being caused by her incurable cancer were discussed at length. The patient wanted to live as long as possible, for her two young children. Using a shared decision-making approach, the management plan focussed on symptom control and giving her more time, for as long as she felt she had good quality of life. All parties recognised the plan had to be fluid and adapt according to her overall health and unavoidable deterioration.

She was started on dexamethasone 8 mg, 12-hourly and given regular snacks, including after during the night. Hypoglycaemic episode frequency was reduced, but some episodes (less than 4 mmol/L) required IV dextrose, especially in the early hours of the morning. The patient agreed to an overnight feed via a nasogastric tube, however, she didn't tolerate this. Instead, she opted for a yogurt drink before bed and early in the morning, accepting the increased risk of dying from a severe hypoglycaemic episode. She agreed to have a peripherally inserted central catheter (PICC) line for IV dextrose when glucose level was below 4. BG monitoring was reduced from hourly to four times a day and she rarely developed symptomatic hypoglycaemia.

Other specialists were consulted - the endocrine team agreed with the management plan and didn't feel octreotide would be of benefit. The oncology team did not consider hypoglycaemia to be caused by her previous oncology treatments.

A few weeks later she died, in hospital, due to advanced mesothelioma. Up until that time she had no symptomatic hypoglycaemic episodes that reduced her consciousness level or ability to be with her family.

DISCUSSION

Normally, the majority of mature IGFs bind to IGFBP-3 and an acid labile subunit (ALS) to form ternary complexes. In NICTH, tumours secrete immature IGF-II, which forms binary complexes with IGF-binding proteins, resulting in small molecular weight complexes, having a greater capillary permeability causing hypoglycaemia by acting on the insulin or IGF-I receptors.¹² Increased IGF-II activity suppresses the secretion of insulin, IGF-I, and growth hormone (GH). Therefore, as presented in our case, typical laboratory findings in NICTH include low levels of glucose, insulin, C-peptide, and IGF-1.

NICTH is an uncommon problem. However, up to 8% of all NICTH cases have been accounted for by mesothelioma and therefore should be considered in refractory hypoglycaemia.¹³

Table 2. Patient investigation results.

Test	Result	Normal Range
Insulin	0.61 mu/L	3 – 25 mU/L
Insulin-like growth factor, IGF-1	<15 ug/L	53.3 - 219 ug/L
C-peptide	0.1 ng/mL	1.1 - 4.4 ng/mL
Morning cortisol	279 nmol/L	138 - 690 nmol/L
Thyroid Stimulating hormone, TSH	3 micU/mL	0.3 - 3 micU/mL

Definite treatment of NICTH often requires surgery and/or chemotherapy. However, this may not always be possible and a multidisciplinary approach focusing on quality of life and symptom control is needed.

As often is the case in the palliative care population, uncertainty can challenge decision-making. We involved the patient and her husband in decision-making and were transparent about expectations. The agreed aim was to manage hypoglycaemia to prevent unconsciousness whilst accepting the limitations because of the underlying incurable condition. We agreed to stop treatments that became unacceptable to her, or futile. We monitored for deterioration and when appropriate, discussed less invasive management options.

The hypoglycaemia was initially successfully managed with as-needed IV dextrose. However, a longer-term, sustainable strategy was sought.

Corticosteroids have been shown to be effective by stimulating gluconeogenesis, suppressing the production of big IGF-II, and correcting the biochemical abnormalities that involve the GH-IGF axis.¹⁴ We initially used a dose of dexamethasone 16 mg daily (equivalent to prednisolone 120 mg) and titrated according to clinical response. Symptom control was achieved at a dose of about 4-6 mg dexamethasone daily. Side effects were well tolerated and her appetite improved, a welcomed side effect. This supports the beneficial effect of corticosteroids on NICTH.

Appropriate oral intake is also important in NICTH. Although oral intake was good, including slow-release carbohydrates, this alone didn't maintain her BG levels and she found feeding via NG intolerable. She required ongoing IV glucose via PICC line. She knew this would mean living the rest of her life in hospital, but this was acceptable as it meant time with her young children.

Another useful tool is the concept of time-limited therapeutic trials. Although it maintained her glucose level, the NG tube was not acceptable to her and was withdrawn. With each treatment proposed the patient/family was involved in decision making and her autonomy and priorities were respected. It was also discussed that treatment would need to be withdrawn, once it was not giving her a quality of life which was acceptable to her.

Our approach can be applied to patients with a possible life expectancy of a couple of weeks or to give a person more time to deal with personal affairs before they die. However, if prognosis is felt to be hours to days, a focus on supportive care addressing symptoms rather than actively correcting blood glucose levels should be considered.

Our approach avoided regular occurrence of severe, symptomatic hypoglycaemic episodes and helped keep

the patient conscious until she deteriorated from disease progression and died a few weeks later.

The endocrine team agreed that octreotide was unlikely to work. Previous case reports have reported that octreotide in NICTH generally doesn't alleviate hypoglycaemia, as somatostatin receptors are likely to be non-functional or not present in the tumour.¹⁵ Glucagon was used in the emergency department but not revisited as it was considered that it wouldn't work due to cachexia. Recombinant human growth hormone (rhGH) was not used as acceptable control with our treatment was achieved, though previous case reports have mentioned benefit from this.⁹

In summary, in patients with mesotheliomas and hypoglycaemia of unclear aetiology, NICTH should be considered. It can cause severe refractory hypoglycaemia. As tumour resection is not feasible in many cases, a multifaceted therapeutic approach needs to be taken and look at other ways to avoid hypoglycaemic episodes, such as corticosteroids, nutrition, slow-release snacks, and IV glucose. Other important factors to consider are prognosis, patient autonomy, family wishes, and considering not treating hypoglycaemia when death is imminent. Shared decision-making in complex clinical scenarios is challenging, but understanding the issue being dealt with and providing adequate information can aid in this.

REFERENCES

1. Silverstein MN, Wakim KG, Bahn RC. Hypoglycemia associated with neoplasia. *The American Journal of Medicine* 1964;36(3):415-23.
2. Kok VC, Lee PH. Management of hypoglycemia in nondiabetic palliative care patients: a prognosis-based approach. *Palliative Care: Research and treatment* 2017;10:PCRT-S38956.
3. Marks V, Teale JD. Tumours producing hypoglycaemia. *Diabetes/metabolism reviews* 1991;7(2):79-91.
4. Schovanek J, Cibickova L, Ctvrtlik F, et al. Hypoglycemia as a symptom of neoplastic disease, with a focus on insulin-like growth factors producing tumors. *Journal of Cancer* 2019;10(26):6475.
5. Garla V, Sonani H, Palabindala V, et al. Non-islet Cell Hypoglycemia: Case Series and Review of the Literature. *Front Endocrinol (Lausanne)* 2019;10:316.
6. Gonzalez F, Roshan R, Levene R, et al. Management of severe hypoglycemia at the end of life in non-diabetic patients: A case study and recommendations. *Journal of Medical Cases* 2015;6(9):413-6.
7. Behringer-Massera S, Brutsaert EF, Epstein EJ. Refractory Hypoglycemia from paraneoplastic insulin-like growth factor 2 Secretion in A Patient with Hepatocellular Carcinoma. *AACE Clinical Case Reports* 2017;3(4):364-6.
8. Ono M, Maeda Y, Koyama N, et al. A case of nonislet cell tumor hypoglycemia associated with malignant mesothelioma requiring a multifaceted approach for optimal glycemic control. *Clinical Case Reports* 2021;9(10):e05028.
9. Wong WK. Non-islet Cell Tumour Hypoglycaemia (NICTH) in Malignant Mesothelioma: Case Report. *The Malaysian Journal of Medical Sciences: MJMS* 2015;22(4):81.
10. Mohammedi K, Abi Khalil C, Olivier S, et al. Paraneoplastic hypoglycemia in a patient with a malignant solitary fibrous tumor. *Endocrinology, Diabetes & Metabolism Case Report* 2014;2014(1).
11. Thomas J, Kumar SC. Nonislet cell tumor hypoglycemia. *Case reports in endocrinology* 2013;2013(1):308086.
12. Bodnar TW, Acevedo MJ, Pietropaolo M. Management of non-islet-cell tumor hypoglycemia: a clinical review. *J Clin Endocrinol Metab* 2014;99(3):713-22.
13. Dynkevich Y, Rother KI, Whitford I, et al. Tumors, IGF-2, and hypoglycemia: insights from the clinic, the laboratory, and the historical archive. *Endocrine Reviews* 2013;34(6):798-826.
14. Teale JD, Marks V. Glucocorticoid therapy suppresses abnormal secretion of big IGF-II by non-islet cell tumours inducing hypoglycaemia (NICTH). *Clinical endocrinology* 1998;49(4):491-8.
15. Perros P, Simpson J, Innes JA, et al. Non-islet cell tumour-associated hypoglycaemia: 111In-octreotide imaging and efficacy of octreotide, growth hormone and glucocorticosteroids. *Clinical endocrinology* 1996;44(6):727-31.

Chronic Regional Pain Syndrome: Emerging Insights and Established Concepts

INTRODUCTION

Complex Regional Pain Syndrome (CRPS) is a chronic and debilitating pain condition primarily affecting the limbs. It is characterized by hyperalgesia (increased sensitivity to pain) and allodynia (pain from non-painful stimuli), often accompanied by sensory, autonomic, motor, and trophic abnormalities. CRPS commonly follows extremity trauma or surgery but remains underreported due to diagnostic challenges and lack of awareness. Misdiagnosis with neuropathic pain syndromes often delays treatment. The introduction of the Budapest Criteria in 2003 has significantly improved diagnostic clarity and remains the gold standard for CRPS diagnosis globally. Patient education plays a crucial role in early identification, adherence to treatment plans, and coping strategies. Empowering patients with knowledge about CRPS may improve outcomes and reduce fear-avoidance behaviours.

DEFINITION AND DIAGNOSTIC CRITERIA

CRPS is classified into two types:

CRPS I: Occurs without identifiable major nerve damage.

CRPS II: Occurs with identifiable major nerve damage.

The Budapest Criteria outlines diagnostic features:

- Continuous pain disproportionate to the inciting event.
- At least one symptom in three of four categories:
 - **Sensory:** Allodynia or hyperalgesia.
 - **Motor/Trophic:** Reduced movement or motor dysfunction.
 - **Sudomotor:** Oedema or altered sweating.
 - **Vasomotor:** Skin colour or temperature asymmetry.
- At least one sign at the time of evaluation in two or more of the same categories.
- Symptoms are not better explained by other diagnoses.

Additional tools such as thermography or skin biopsy may enhance diagnostic accuracy in equivocal cases.

Differential diagnoses include peripheral neuropathies, inflammatory arthritis, vascular disorders, and somatoform pain disorders. A careful clinical assessment is essential to avoid misdiagnosis and inappropriate treatment.

RISK FACTORS

CRPS is more prevalent in women and is often triggered by trauma, fractures, or surgery. Associated conditions include fibromyalgia and carpal tunnel syndrome, although its overall prevalence remains low. Emerging risk factors include smoking, psychological factors such as anxiety or depression, and certain genetic predispositions (e.g. alterations in the HLA gene complex located on chromosome 6).

PATHOPHYSIOLOGY

The mechanisms underlying CRPS are multifactorial and involve:

- **Peripheral Nervous System:** Early injury leads to nociceptive sensitisation and release of pro-inflammatory mediators, lowering pain thresholds.
- **Central Nervous System:** Persistent nerve stimulation enhances synaptic activity in the dorsal horn, amplifying pain perception.
- **Autonomic Dysregulation:** Acute phases involve decreased norepinephrine levels, causing warmth and swelling, which later shift to cold, cyanotic limbs due to catecholamine changes.
- **Autoimmune Factors:** Elevated neuropeptides may trigger inflammatory responses, prolonging inflammation and delaying healing.
- **Genetics:** Alterations in the HLA gene complex may predispose individuals to CRPS-related fixed dystonia.

Emerging research suggests a potential role for mitochondrial dysfunction and oxidative stress in CRPS pathophysiology.

Figure 1.
Image of patient with
lower extremity CRPS.



DIAGNOSIS

The diagnosis of CRPS relies on clinical evaluation based on history, examination, and exclusion of alternative diagnoses:

- **History:** Patients typically present with pain disproportionate to trauma in a non-dermatomal distribution.
- **Physical examination:** Comparison of the affected and unaffected limbs for sensory, vasomotor, sudomotor, and motor/trophic abnormalities as outlined by the Budapest Criteria.
- **Investigations:** Blood tests, imaging (e.g. bone scintigraphy, thermography) and nerve conduction studies help rule out alternative diagnoses.

Practical tools such as validated questionnaires and pain scales (e.g. McGill pain questionnaire) can assist in assessing severity and monitoring treatment response.

MANAGEMENT OPTIONS

CRPS treatment in Malta follows global best practices and incorporates conservative, pharmacological, and interventional approaches:

- **Conservative therapies:** Physical therapy, mirror therapy, acupuncture, and TENS are first-line interventions. Graded motor imagery has shown promise in the early stages of CRPS.
- **Pharmacological treatments:**
 - **Analgesics:** NSAIDs, opioids.
 - **Neuropathic pain medications:** Gabapentin, amitriptyline.
 - **Corticosteroids:** For short-term relief of inflammation.
 - **Topical agents:** Anaesthetic (lidocaine and prilocaine) as well as ketamine creams to reduce allodynia and hyperalgesia.
 - **Sympathetic blockers:** Clonidine.
 - **Bisphosphonates and low-dose naltrexone** are emerging therapies with encouraging results.

- **Interventional techniques:** Sympathetic plexus blocks e.g. stellate ganglion blocks and spinal cord stimulation (SCS). Dorsal root ganglion stimulation (DRG-S) offers targeted pain relief and is being evaluated as a potential standard of care for refractory CRPS.

DISCUSSION

The management of CRPS remains challenging due to its complex and multifactorial pathophysiology, necessitating a multidisciplinary and patient-centred approach. While several treatment modalities show promise, variability in patient response highlights the need for individualized care plans and ongoing research.

Prognosis varies considerably. Early diagnosis and prompt intervention are associated with better outcomes. However, a subset of patients may experience persistent symptoms and disability despite treatment. Long-term follow-up and functional rehabilitation remain essential components of care.

CONCLUSION

Timely diagnosis and comprehensive management strategies are critical for improving outcomes for CRPS patients. Collaborative efforts, both locally and internationally, are essential to enhance access to emerging therapies and optimize care delivery.

BIBLIOGRAPHY

1. Harden NR, Bruehl S, Perez RSGM, et al. Validation of proposed diagnostic criteria (the "Budapest Criteria") for Complex Regional Pain Syndrome. *Pain* 2010;150(2):268-274.
2. Goebel A, Barker CH, Turner-Stokes L, et al. Complex regional pain syndrome in adults: UK guidelines for diagnosis, referral and management in primary and secondary care. London: RCP, 2018.
3. Bruehl S. Complex regional pain syndrome. *BMJ* 2015;351:h2730.
4. Birklein F, Schlereth T. Complex regional pain syndrome-significant progress in understanding. *Pain* 2015;156 Suppl 1:S94-S103.

Introducing Embrace:

A New KVF Programme

Supporting Young Patients Through Illness

The Karl Vella Foundation (KVF) is proud to introduce Embrace, **a new mental health programme designed specifically for children and adolescents aged 5 to 17 who are facing serious, rare, or life-limiting illnesses.** Whether they are receiving treatment in Malta or abroad, including palliative care, Embrace offers these young patients a safe and therapeutic space to support their emotional well-being during an incredibly vulnerable time.

Through small, weekly group sessions led by qualified mental health professionals, participants are given the **tools to build emotional resilience, develop healthy coping strategies, and experience a genuine sense of connection** with others who understand what they are going through. The groups are carefully tailored to different age brackets, ensuring each child receives age-appropriate support. **Sessions are held both online and in person**, providing much-needed flexibility for children at home, in hospital, or abroad.

Creative therapeutic approaches lie at the heart of Embrace. Children are encouraged to explore and express their emotions through art, crafts, narrative therapy and mindfulness. These methods help them to process their feelings in ways that feel natural and empowering. Importantly, they do not go through this journey alone - they do so surrounded by peers who are facing similar challenges.

Initial feedback has been deeply encouraging. One parent shared, **"He really enjoys the sessions and really looks forward to them, so thank you very much for the efforts and the work and time."**

Another commented, **"She is really enjoying her space."** These heartfelt words are a testament to the meaningful impact Embrace is already making in the lives of young patients and their families.

This new programme complements KVF's existing range of free services supporting families facing illness or loss. These include **The Wellness Pod**, which provides emotional and educational support to children affected by the illness or loss of a family member; **Because You Matter**, which provides psycho-emotional support to patients, donors and their caregivers undergoing treatment abroad; and **Life Beyond Loss**, a grief therapy group that helps individuals navigate the emotional impact of losing a loved one. KVF also offers the **Lifeloam Training Hub**, which provides training to professionals in the social and educational sectors, as well as parents, companies, and the wider public.

We strongly encourage doctors, nurses, paediatric teams, oncology units, and other health professionals to refer young patients who may benefit from Embrace. Your role is crucial in identifying children facing serious illness and helping families access the emotional care they need during what is often an overwhelming time.

Together, we can support the holistic care of young patients, helping them find strength, connection, and hope when they need it most.

Referrals to Embrace can be made quickly and easily via our online form: <https://shorturl.at/pWUoc>

To find out more about KVF and our services, visit www.kvf.org.mt or contact us at info@kvf.org.mt.



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DermaVenFest 2025

Saturday 15th November 2025

The Palace Hotel, Sliema

The Maltese Association of Dermatology & Venereology (MADV) will be holding its customary annual CME meeting in 2025 after a break of a few years, this absence being largely due to COVID and clashes with other International Dermatology & Venereology meetings hosted locally.

The familiar DermFest theme has been upgraded to DermVenFest in recognition of the Venereology/GU component of our speciality, which forms an important part of the scientific program. The 2025 meeting is scheduled for Saturday 15th November and will take the form of Reviews & Updates, targeting local medical practitioners and students, delivered by a formidable line-up of local and foreign speakers.

Topics covered will include cutaneous inflammatory disorders, cutaneous infections, cutaneous neoplasia and malignancy, cutaneous manifestations of systemic disease and of internal malignancy, maternal dermatoses in pregnancy, non-infectious vulval and penile dermatoses, sexually transmitted infections, psychodermatoses, and disorders of hair and nails.

More details on the scientific program and registration will be announced in due course.

Look forward to your participation!

Lawrence Scerri
President
MADV



Do you want to share **the scientific program of your conference or seminar** with colleagues?
Contact us at ian.c.ellul@gmail.com.



Comparing Transoral Endoscopic Thyroidectomy Approaches: CO₂ Insufflation versus Gasless Technique

ABSTRACT

Transoral endoscopic thyroidectomy vestibular approach (TOETVA) offers a scar-free alternative to traditional thyroidectomy but poses risks when performed with CO₂ insufflation, particularly the risk of CO₂ embolism. This manuscript compares CO₂-insufflated TOETVA with the gasless technique, which uses novel retractors to create a working space, thus minimising insufflation-related complications. While CO₂ insufflation enhances visualisation, it presents physiological risks that limit its use in patients with cardiopulmonary concerns. The gasless approach, though requiring specialised equipment and training, mitigates these risks and may extend TOETVA candidacy. This comparison highlights patient selection considerations and the evolving techniques that enhance safety in minimally invasive thyroid surgery. Further research on long-term outcomes will help refine TOETVA methods.

INTRODUCTION

Thyroid surgery has witnessed significant advancements, with techniques such as Transoral Endoscopic Thyroidectomy Vestibular Approach (TOETVA), which offers a scarless alternative to conventional open surgery. TOETVA, which accesses the thyroid through a vestibular entry, is gaining popularity for its aesthetic benefits and decreased postoperative scarring.¹ However, similar to other endoscopic techniques, it relies on CO₂ insufflation, which is used to create space and visibility for the surgeon, and has the potential risk of CO₂ embolism, a rare but serious complication.² This literature explores the safety profiles of TOETVA using CO₂ insufflation techniques vs a gasless approach, focusing particularly on the risk of CO₂ embolism and how it affects clinical decision-making in thyroid surgery.

TOETVA is a minimally invasive thyroidectomy technique performed through incisions inside the mouth, allowing surgeons to access the thyroid without visible neck scars and offering cosmetic benefits that

enhance patient satisfaction. Additionally, since TOETVA is minimally invasive, it typically results in faster recovery times and less postoperative pain than with traditional open procedures. This has been noted in recent literature, such as the analysis of 110 cases in 2021 showing positive surgical outcomes with this technique.³ However, of these 110 cases, two had to be converted to open techniques, one of which was due to the suspicion of CO₂ embolism.

Side-effects of TOETVA include potential increased infection risks and minor trauma within the mouth, so much so that antibiotic prophylaxis has been suggested to avoid the complication of infection and abscess formation.³ Additionally, TOETVA poses the risk of mental nerve injury with subsequent hypoesthesia of the lower mandible and neck.

CO₂ insufflation is commonly used in endoscopic and laparoscopic surgeries and facilitates an expanded operative space by inflating the body cavity to create the working space required, which in TOETVA, inflates the operative field around the thyroid gland. This ability to create a stable and clear visual field is crucial for procedures requiring precise navigation, such as thyroidectomy. In TOETVA, the CO₂ pressure displaces tissues gently but effectively, allowing the surgeon to access the thyroid gland without major disturbance to surrounding structures. Additionally, CO₂ is highly soluble in blood, thus in the event of minor absorption, the gas can typically be eliminated without significant risk of harm. Although this setup allows better visualisation, it also raises safety concerns as it has been associated with complications such as gas embolism, particularly when venous access points are inadvertently created. An embolism occurs when gas enters a blood vessel and travels through the bloodstream, potentially blocking blood flow and leading to severe cardiovascular complications. This risk, while infrequent, is heightened in the head and neck areas as the proximity to major vessels increases the potential for gas to enter the bloodstream, creating embolic events that can compromise patient safety. Even a small amount of CO₂ entering the bloodstream at these points can result in systemic

embolization, causing life-threatening cardiovascular or respiratory issues.³ This has been recorded in 2016 where a patient suffered this rare, potentially life-threatening complication during endoscopic thyroidectomy.⁴

Incidents of embolism have varied across studies, with higher rates typically reported in surgeries involving high-pressure CO₂ insufflation or prolonged procedural times. Factors such as pre-existing cardiovascular conditions, vessel integrity, and procedural techniques all influence embolism risk.⁵ The occurrence of CO₂ embolism can have severe outcomes, including hypotension, arrhythmias, and in extreme cases, cardiovascular collapse. For this reason, monitoring systems are often in place to detect early signs of embolism, allowing the surgical team to take immediate corrective action if necessary. The risk of delayed bleeding is another complication noted due to the CO₂ insufflation used during this procedure, as it has been noted to be concealed intra-operatively due to the tamponade effect the insufflation of CO₂ offers.³

CO₂ insufflation was also linked to subcutaneous emphysema and hypercarbia. Subcutaneous emphysema occurs when CO₂ gas accumulates in the subcutaneous tissues, leading to swelling and discomfort. Although generally self-limiting, this can be concerning for patients and may require further treatment to resolve. Hypercarbia, or elevated CO₂ levels in the blood, is another risk, especially if the gas is absorbed rapidly. While the body can often compensate for mild increases in CO₂, patients with compromised respiratory function or underlying lung disease may be at higher risk of complications. One of these complications is increased intracranial and intraocular pressure, which is particularly of note in patients suffering from glaucoma. Many patients with glaucoma are undiagnosed, and are susceptible to 'potential damage induced by having intermittent rise in IOP' induced by CO₂ insufflation.⁶ Due to this, glaucoma has been recommended as a contra-indication for the use of CO₂ insufflation, and further studies have been recommended for the evaluation of such cases.

Other complications have been reported, as was evident in a published report in 2020, which mentioned a case where side-effects of TOETVA included pneumoperitoneum and pneumo-mediastinum.⁷ Documented cases of these complications underscore the importance of careful patient selection and monitoring.

To further mitigate these risks, surgeons using CO₂ insufflation in TOETVA often adhere to strict pressure limits, ideally less than 5mmHg,³ which minimises gas absorption. The patient's positioning during surgery, commonly in a slight Trendelenburg – patient lies supine with feet elevated above head - also influences the distribution and retention of CO₂. Additionally, careful monitoring of end-tidal CO₂ levels is imperative to detect hypercarbia early.³ Some studies suggest that implementing intermittent insufflation, wherein CO₂ is periodically stopped to allow for gas reabsorption, may reduce embolism risk. However, this requires a highly skilled surgical team capable of rapidly adjusting techniques based on real-time patient feedback.³

These effects have led to the development of a gasless technique, which eliminates CO₂ usage while preserving the key benefits of the procedure. This gasless technique utilises novel retractors to create a working space. These retractors elevate the soft tissue without the need for insufflation, maintaining adequate visualisation while avoiding the physiological complications associated with CO₂. A paper published in 2019⁸ reviewed 15 cases of gasless TOETVA using a self-retaining retractor, with no reported serious postoperative complications, and no visible scarring on the neck. This showed that surgery was indeed possible and successful without the use of CO₂ insufflation. The retractor utilised comprised a newly developed retractable blade, which was fixed after insertion, to the body of the self-retaining retractor system. Notably, to aid visualisation, 'a percutaneous suture was placed on the roof akin and hung from a retractor'.⁸ In comparison, another paper published recently in 2023⁹ also reported positive outcomes with gasless submental-transoral combined approach endoscopic thyroidectomy (STET), where all 75 patients were performed using this technique without necessitating the conversion to open procedures.

Furthermore, Camenzuli *et al* also developed a specialised retracting device for TOETVA (US Patent No. 957634S1). This device was evaluated through the use of Thiel embalmed cadavers to replicate the surgical technique, with blinded questionnaires to thyroid surgeons who compared images from standard TOETVA and the gasless route. The results were promising, showing that the new retraction device offered similar visibility and reduced risks of CO₂ embolism.^{10,11}

IN OUR OPINION, COMBINING GASLESS TECHNIQUES WITH LIMITED INSUFFLATION COULD STRIKE A BALANCE, USING MINIMAL CO₂ ONLY WHEN CRITICAL FOR VISUALISATION, THEN REVERTING TO RETRACTION-ONLY TECHNIQUES

Using retractors, however, is not without its own challenges. The absence of CO₂ can limit the surgeon's view of deeper anatomical structures, requiring more adept handling of instruments to maintain a clear operative field. Surgeons may experience difficulty with visibility, which could increase operative time and fatigue. Furthermore, gasless TOETVA requires specialised equipment and additional training. Familiarity with the specific retraction systems, along with increased experience in transoral techniques, is critical to achieving optimal visualisation without insufflation. A recent review highlighted that while gasless endoscopic thyroidectomy techniques, including TOETVA, avoid the complications associated with CO₂ insufflation, such as subcutaneous emphysema and hypercapnia, the trade-off is a potentially steeper learning curve due to the reliance on mechanical retraction for exposure.¹² Findings suggest that operative times may be prolonged initially as surgeons adapt to these methods, underscoring the importance of structured training and increased experience in optimising surgical efficiency. Consequently, adopting the gasless approach may require a steeper learning curve, especially for surgeons accustomed to traditional insufflation methods.³

A critical factor in choosing between insufflation and gasless TOETVA is patient selection. Identifying patients at risk for CO₂ related complications is essential to determine the most suitable technique. Patients with a history of respiratory or cardiovascular disorders may not tolerate CO₂ insufflation, as the added gas load and positioning required for TOETVA could exacerbate underlying conditions. In such cases, the gasless method becomes a safer alternative. For younger patients with a high priority on aesthetic outcomes, the choice of TOETVA itself aligns well with their goals, but the use of gasless techniques allows for an added safety buffer if they are at risk for embolism or related complications.³

In our opinion, combining gasless techniques with limited insufflation could strike a balance, using minimal CO₂ only when critical for visualisation, then reverting to retraction-only techniques. This hybrid approach presents an area for further exploration, particularly in patients for whom both visualisation and safety are equally high priorities.

As TOETVA continues to gain traction, advancements in surgical equipment and techniques will likely address the limitations of both insufflation and gasless methods. For instance, there is potential for more refined, less invasive retraction systems that could allow for clearer visualisation without CO₂ or with only minimal insufflation. Additionally, optical technologies such as 3D endoscopy and intraoperative imaging may offer improved visualisation, reducing the need

for CO₂ and allowing for safer manipulation in delicate anatomical spaces.

Further studies comparing clinical outcomes, complication rates, and patient satisfaction between insufflation and gasless TOETVA are needed to validate each technique's efficacy. As more data emerges, protocols for patient selection can be refined, and hybrid approaches optimised. Multicentre trials comparing embolism risk, operative time, and learning curve for the gasless method versus insufflation-dependent TOETVA will provide valuable insights for surgeons adopting these approaches.

CONCLUSION

TOETVA represents a significant advancement in minimally invasive thyroid surgery, offering a scar-free approach with improved aesthetic outcomes. However, the choice between CO₂ insufflation and a gasless approach should be tailored to individual patient profiles, considering the safety risks and technical demands of each technique. While CO₂ insufflation provides easier visualisation, its associated complications, particularly embolism, limit its use in high-risk patients. The gasless approach, by contrast, eliminates these risks but requires specialised equipment and a skilled surgical team for effective application. Combining gasless techniques with limited insufflation could be another option. With ongoing technological developments and increased understanding of patient risk factors, TOETVA can continue to evolve toward a safer and more accessible option for patients and surgeons alike.

REFERENCES

1. Le QV, Ngo DQ, Ngo QX. Transoral endoscopic thyroidectomy vestibular approach (TOETVA): A case report as new technique in thyroid surgery in Vietnam. *Int J Surg Case Rep*. 2018;50:60-63.
2. Camenzuli C, Schembri Wismayer P, Calleja Agius J. Transoral Endoscopic Thyroidectomy: A Systematic Review of the Practice So Far. *JSL* 2018;22(3):e2018.00026.
3. Chai YJ, Chae S, Oh MY, et al. Transoral Endoscopic Thyroidectomy Vestibular Approach (TOETVA): Surgical Outcomes and Learning Curve. *J Clin Med* 2021;10(4):863.
4. Rajan S, Paul J, Kumar L. Carbon dioxide embolism during endoscopic thyroidectomy. *Indian J Anaesth* 2016;60(1):65-6.
5. Yap RV, Buenafe AA, Tankiaty J, et al. Carbon dioxide embolism during transoral endoscopic thyroidectomy: A case report and literature review. *Asian J Endosc Surg* 2023;16(4):774-780.
6. Camenzuli C, Schembri-Wismayer P, Calleja-Agius Jean. Association between carbon dioxide insufflation in endoscopic thyroidectomy and intra-ocular pressure (IOP). Is insufflation contra-indicated in glaucoma patients? *Oral Oncology* 2021;113:105022.
7. Kwek JWM, Pang MJ, Heah HHW. Pneumoperitoneum after transoral endoscopic thyroidectomy vestibular approach. *Laryngoscope Investig Otolaryngol* 2020;5(3):580-583.
8. Park JO, Park YJ, Kim MR, et al. Gasless transoral endoscopic thyroidectomy vestibular approach (gasless TOETVA). *Surg Endosc* 2019;33: 3034-3039.
9. Jiang J, He G, Chu J, et al. Gasless submental-transoral combined approach endoscopic thyroidectomy: a new surgical technique. *Front Oncol* 2023;13:1115927.
10. Camenzuli C. Development of a scarless and gasless trans-oral video-assisted thyroidectomy. Doctoral dissertation, 2021. University of Malta.
11. Camenzuli C, Attard J, Borg JP, et al. Cadaveric Evaluation of a Device Supporting Gasless Transoral Endoscopic Thyroidectomy. *Surg Innov* 2020;27(4):410-411.
12. Cheng X, Ding X, Wang S, et al. Progress in gasless endoscopic thyroidectomy. *Front Endocrinol (Lausanne)* 2024;15:1466837.



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Helminth-induced Pancreatitis: Case Report and Literature Review

ABSTRACT

Hepatobiliary and pancreatic ascariasis is a rare cause of pancreatitis in the Western World, with only individual cases reported. We present the case of a 24-year-old man who presented with a 3-month history of recurrent abdominal and back pain, bloating, nausea, anorexia and cachexia. Pancreatitis was confirmed with blood investigations and CT scan. No causative factors were identified on abdominal US, MR cholangiopancreatography or endoscopic US. The patient claimed to notice worm fragments in his feces three months after initial presentation. Fecal analysis confirmed the presence of helminth fragments, suggesting hepatobiliary and pancreatic ascariasis despite lack of travel to endemic regions. The patient was treated with mebendazole 100 mg bid for 3 days which resolved his symptoms completely. He remained well at 12-month follow-up. Fecal analysis should be considered in patients with pancreatitis of unknown etiology.

BACKGROUND

Pancreatitis is defined as an inflammation of the pancreatic parenchyma and can be divided into acute and chronic forms. Acute pancreatitis usually results in severe abdominal pain, elevated serum amylase or lipase, and a systemic inflammatory response (SIRS). Acute pancreatitis may be mild or severe and may cause local complications and/or organ dysfunction. The mortality of this disease can be as high as 20-50% in severe illness.¹

In the Western world, alcohol and gallstones are the most common causes of acute pancreatitis. In contrast, hepatobiliary and pancreatic ascariasis (HPA) is common in Asia, Africa and South America where ascariasis is endemic, accounting for up to 23% of cases and is second only to cholelithiasis as a cause for pancreatitis.² The mean age for HPA is 35 years. HPA affects females more than males at a ratio of 3:1.³

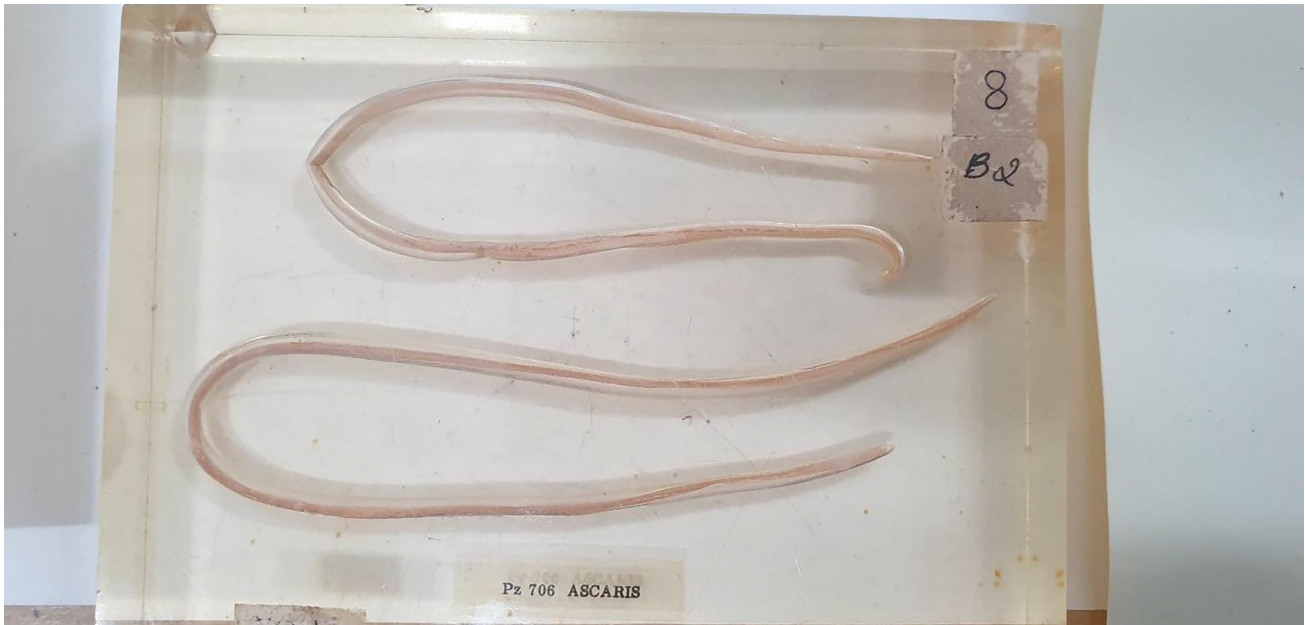
CASE PRESENTATION

A previously healthy 24-year-old male presented at the A&E department at MDH with a 3-month history of recurrent episodes of abdominal and back pain, bloating, nausea, anorexia and cachexia. He denied alcohol use, recent exotic travel abroad, recent abdominal trauma and any medicinal/recreational drug intake. He could not identify a particular trigger for the symptoms or a specific event preceding the onset of symptoms. He was a Maltese national who worked as a chef in a restaurant.

INVESTIGATIONS

On presentation to the Accident & Emergency department, the patient was afebrile and hemodynamically normal. His serum amylase peaked at 206 U/l and the serum lipase was 120 U/l, confirming acute pancreatitis. The patient's full blood count, renal and liver profiles, serum calcium, lipid profile and serum IgG-4 were all normal. A CT scan of the abdomen and pelvis identified minimal peri-pancreatic fat stranding. The US excluded gallstones as a cause. Follow-up MR pancreas with MR cholangiopancreatography (MRCP) was normal. Bilio-pancreatic endoscopic US (EUS) was likewise normal; there was no dilatation of the pancreatic duct. At this stage, the causative factor was still unidentified and it was decided to run a fecal calprotectin which returned an elevated value of 1820 µg/g. A Colonoscopy and ileoscopy, and stool analysis for ova and parasites were however, entirely normal. Despite all of these advanced diagnostic tests returning normal results, his hyperamylasemia and episodic abdominal pain went on unabated. He was discharged home once he was clinically well; his symptoms resolved with IV fluid hydration and simple analgesia. However, the cause for the patient's pancreatitis was not yet established. This dilemma ended when 2 months after presentation, the patient noted parts of a worm in his faeces and upon stool analysis of said worm, *Ascaris lumbricoides* worm was identified.

Figure 1. *Ascaris lumbricoides* worm (Source: University of Malta, Biology Department).



TREATMENT

Endoscopic retrograde cholangiopancreatography (ERCP) may be a therapeutic tool for HPA-induced pancreatitis. However, the need for this may be avoided by giving anti-helminthic drugs which paralyse the roundworm, which will eventually be expelled by the peristaltic activity of the intestines.⁴ These drugs include mebendazole, albendazole and ivermectin.⁵ If symptoms persist up to 3 weeks post anti-helminthic therapy, ERCP for retrieval of dead *Ascaris* products is suggested.⁶ The patient was treated with mebendazole 100 mg bid for 3 days. This resolved his symptoms completely and he remained well 12 months after this treatment.

OUTCOME AND FOLLOW-UP

The patient was followed up at outpatients at regular intervals. He remained well 12 months after treatment with anti-helminthic drugs. Follow-up blood tests showed resolution of all deranged enzymes. Fecal calprotectin decreased to normal values. Repeat imaging was not performed. The patient has been asymptomatic since finishing his course of mebendazole.

DISCUSSION

Our suspicion is that this patient contracted the *Ascaris* worm because of poor food hygiene practices, whilst handling contaminated food during his work as chef. *Ascaris lumbricoides* is a soil-transmitted roundworm. The adult female worms produce thousands of eggs

daily that are passed in feces and, if conditions allow, deposited in soil. Once in soil, infective larvae of *Ascaris* develop in the eggs and, if ingested by a human host, hatch and develop into adult worms over several months.

Pancreatitis secondary to HPA is thought to arise from obstruction of the common bile duct or the pancreatic duct by the head of the adult roundworm.⁷ This would explain why, even though ascariasis is common in children, pancreatitis secondary to HPA is not, since the ampulla is too small for the roundworm to enter and eventually obstruct. The ampulla is where the pancreatic duct and bile duct merge to drain into the duodenum. This theory also accounts for the reason why HPA pancreatitis is a complication of biliary surgery such as cholecystectomy or ERCP for gallstone disease. The intervention is thought to facilitate worm invasion since these procedures widen the ampullary orifice and lead to easier passage of worms into the bile ducts.

Nearly all patients with *Ascaris*-related pancreatitis present with abdominal pain, and many also report back pain, nausea, vomiting, and worm emesis. These symptoms, in addition to a serum amylase which is approximately 3 times the upper limit of normal, are diagnostic for acute pancreatitis. Imaging studies, such as abdominal US and Abdominal CT will demonstrate a dilated pancreatic duct in patients with HPA pancreatitis. HPA radiologic findings are very nonspecific however bile duct dilatation is seen on CT and MRI.³

EUS may also be used to visualize the *Ascaris* roundworm.⁸ Further investigation with MRCP should also describe a dilated pancreatic duct, as well as peripancreatic oedema and a smooth linear filling defect. However, in our case both EUS and MRCP were normal. The gold standard of a diagnosis of HPA is an ERCP, which is both diagnostic and therapeutic, as the roundworm may be visualised to confirm the diagnosis, as well as retrieved. The pancreatic duct may need to be dilated at ERCP to facilitate evacuation of the *Ascaris*.⁹

If therapeutic ERCP is not performed, complications such as recurrence of pancreatitis may occur if roundworm remnants are retained in the pancreatic duct and calcify.

Another complication which may occur is gallstone formation. Debris such as dead or fragmented worms may serve as a nidus for intrahepatic biliary stone formation if not removed.¹⁰

TAKE HOME MESSAGES

- Acute pancreatitis can be a severe illness with high mortality if adequate treatment is not started early. Although gallstones and alcohol remain the main causes of acute pancreatitis in the Western world, helminth-induced pancreatitis is a diagnosis that must be considered in the returning traveler with a clinical picture that fits acute pancreatitis.

- Optimal treatment for HPA pancreatitis is usually medical (anti-helminthic medication), however, ERCP and worm extraction may also be of benefit to reduce the risk of complications secondary to retained products of the roundworm.
- The case we present highlights the importance of having a high index of suspicion for helminth infection as a cause of 'idiopathic', recurrent episodes of acute pancreatitis, even in patients where no recent travel history to endemic regions is evident.

REFERENCES

- 1 Williams N, O'Connell PR, McCaskie A [eds.]. Bailey & Love's Short Practice of Surgery. 27th ed. CRC Press 2018.
- 2 Parenti DM, Steinberg W, Kang P. Infectious causes of acute pancreatitis. *Pancreas* 1996;13:356–371.
- 3 Khuroo M, Zargar S, Yattoo G, et al. Worm extraction and biliary drainage in hepatobiliary and pancreatic ascariasis. *Gastrointestinal Endoscopy* 1993;39(5):680-5.
- 4 Rawla P, Bandaru S, Vellipuram A. Review of Infectious Etiology of Acute Pancreatitis. *Gastroenterology Research* 2017;10(3):153-8.
- 5 Khuroo M, Mahajan R, Zargar S, et al. Biliary and pancreatic ascariasis: A long-term follow up. *The National Medical Journal of India* 1989;2:4-7.
- 6 Kenamond C, Warshauer D, Grimm I. *Ascaris* Pancreatitis. *RadioGraphics* 2006;26(5):1567-70.
- 7 Mangiavillano B, Carrara S, Petrone M, et al. *Ascaris lumbricoides*-induced acute pancreatitis: diagnosis during EUS for a suspected small pancreatic tumor. *Journal of the pancreas* 2009;10(5):570–2.
- 8 Khuroo MS, Rather A, Khuroo N, et al. Hepatobiliary and pancreatic ascariasis. *World journal of Gastroenterology* 2016;22(33):7507–17.
- 9 Khuroo MS. Ascariasis. *Gastroenterology clinics of North America* 1996;25(3):553–77.
- 10 Kenamond C, Warshauer D, Grimm I. *Ascaris* Pancreatitis. *RadioGraphics* 2006;26(5):1567-70.

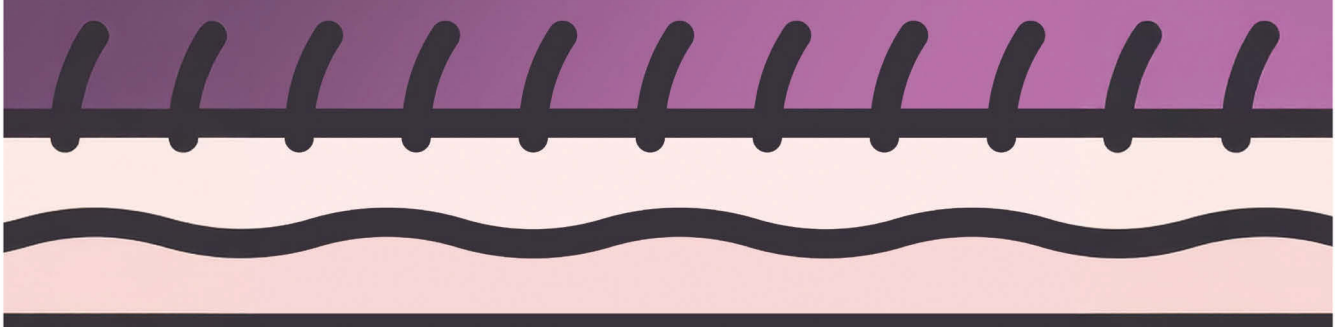


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Public Perceptions of Preoperative Fasting Among the General Public in Malta

INTRODUCTION

Preoperative fasting before general anesthesia is a crucial measure for reducing the risk of pulmonary aspiration. In Malta, patients are traditionally instructed by the Pre-Operative Assessment Clinic to commence fasting from midnight before their procedure. This practice persists despite local guidelines issued by Mater Dei Hospital (MDH), which recommend a fasting period of six hours for solid food and two hours for clear fluids. The MDH guidelines explicitly state that patients scheduled for morning surgery may consume solid food until midnight and clear fluids until 5:30a.m.

Emerging research indicates that shorter fasting durations offer significant benefits, particularly for elderly individuals and young children. Consequently, several organizations, including the European Society of Anaesthesiology and Intensive Care (ESAIC), have issued guidelines advocating for a standardized, evidence-based approach to preoperative fasting. These recommendations seek to minimize the risk of pulmonary aspiration while enhancing patient comfort and clinical outcomes. The most recent ESAIC guidelines, published in 2011, prohibit solid food intake within six hours of surgery but permit the consumption of clear fluids up to two hours before the procedure.

This study sought to evaluate public awareness and perceptions of preoperative fasting through two outreach events held in 2024: the Association of Anaesthesiologists of Malta's stand at *Science in the City 2024* in Valletta (September), and the *World Anaesthesia Day* celebrations at the Mater Dei Hospital main foyer (October).

METHODOLOGY

The educational events targeted the general public, welcoming participants from diverse age groups, nationalities, and backgrounds. A brief multiple-choice questionnaire was designed to gather information on participants' knowledge of preoperative fasting. The questions included: 'Are you aware that you need to fast before anaesthesia?', 'How many hours do you need to fast for food?', 'How many hours do you need to fast for clear fluids?', 'Do you know why we need to fast before anaesthesia?', and 'Do you think prolonged fasting can be harmful?'.

Trainees and specialists from the Department of Anaesthesia, Intensive Care, and Pain Medicine, as well as anaesthetic nurses, approached participants using random, convenience sampling during the events. Participation in the survey was voluntary, and responses were anonymized. Demographics of the sampled population were not recorded. Data were recorded using a Google Form and subsequently analysed.

RESULTS

Fasting before elective surgery is a critical aspect of preoperative preparation, yet public awareness of these fasting protocols varies significantly. This audit evaluates the understanding of fasting protocols among individuals randomly surveyed during two public events. A total of 125 responses were analysed. The first question assessed general awareness by asking participants, 'Are you aware that you need to fast before anaesthesia?' An overwhelming 92% of respondents answered 'Yes', indicating broad recognition of the necessity of fasting, while 8% responded 'No'.

Participants were then asked, 'How many hours do you need to fast for food?'. This multiple-choice question included options ranging from 2 to 12 hours, with the flexibility for unique responses. The results showed that 0.8% of participants thought the fasting period was one hour, 2.4% believed it was two hours, 7.2% chose four hours, 37.6% selected six hours, 34.4% opted for eight hours, 4.8% answered ten hours, 11.2% said twelve hours, and 1.6% responded with 24 hours. The most common responses were six and eight hours, accounting for 72% of the answers. A six-hour fasting period for solid food is consistent with current guidelines set by ESAIC, whereas an eight-hour fasting period - specifically for foods high in fat or protein - aligns with the recommendations issued by the ESAIC Guideline Task Force in preparation for their forthcoming updated guidelines on preoperative fasting.

The third question, 'How many hours do you need to fast for clear fluids?', revealed gaps in awareness. Responses showed that 48% of participants correctly identified two hours as the recommended fasting time for clear fluids. However, 15.2% believed four hours was necessary, 14.4% selected six hours, 16% chose eight hours, 2.4% answered ten hours, and 4% believed

twelve hours was required. This result highlights that more than half of the participants were unaware of the recommended guidelines for clear fluid fasting.

The fourth question sought to evaluate participants' understanding of why fasting is required. It provided three multiple-choice options: preventing food from coming up from the stomach and entering the lungs, preventing nausea after anaesthesia, and making organs easier to identify and handle during surgery. Additionally, participants could submit unique answers. The results showed that 52% correctly identified the prevention of aspiration as the primary reason for fasting. Another 25.6% believed fasting prevents nausea after anaesthesia, while 14.4% selected the facilitation of surgical visibility. A further 6.4% provided unique responses, such as "to ensure that the blood is pure", "to reduce the amount of energy wasted", "to prevent urination", "to relax the muscles", "to reduce the amount of anaesthesia used", "to prevent complications during surgery", and "to ensure that no pain is felt". 1.6% recorded no response for this question.

The final question, 'Do you think prolonged fasting can be harmful before surgery?', yielded varied responses. A majority of 60% acknowledged the potential harm of extended fasting, while 39.2% did not. One response was not recorded. These results underscore the need for improved staff education on preoperative fasting and the risks associated with prolonged fasting, to ensure that patients receive accurate and informed guidance.

DISCUSSION

The findings of this study demonstrate that there is a general awareness of the need of adequate fasting guidelines and the rationale behind preoperative fasting for elective surgery. However, significant scope remains for further education and awareness. International guidelines issued by ESAIC provide a comprehensive overview of current knowledge on preoperative fasting. These guidelines enable medical practitioners, including anaesthesiologists across Europe, to incorporate this knowledge into their daily practice to ensure optimal patient care.

Preoperative fasting is defined as a prescribed period before a surgical procedure during which

patients are prohibited from consuming solids or liquids orally. This standard surgical practice aims to minimize the risk of pulmonary aspiration during anaesthesia. However, prolonged liquid fasting beyond the recommended guidelines can lead to a range of complications, including dehydration, acute kidney injury, hypoglycaemia, discomfort, and an increased physiological stress response. Prolonged fasting has also been associated with delayed recovery, postoperative nausea and vomiting, and impaired wound healing, all of which compromise patient safety, prolong hospital stays, and escalate healthcare costs.¹⁻³

Prolonged fasting contributes to hunger, thirst, and activation of the sympathetic nervous system, resulting in irritability and anxiety. It suppresses insulin secretion while elevating growth hormone and glucagon levels, thereby disrupting glucose metabolism and causing electrolyte imbalances. Insulin resistance, a common postoperative phenomenon, is further exacerbated by excessively long fasting periods, reducing the body's ability to combat infections, repair tissues, and heal wounds effectively.²⁻³

Recent studies have explored the minimal safe fasting period for solid foods. Evidence suggests that residual solids in the stomach at the time of anaesthetic induction cannot be reliably excluded with fasting durations of only 2-4 hours.^{1,4} Consequently, the current recommendation is to avoid solid foods for at least six hours before surgery, with the ASA guidelines extending this requirement to eight hours for meals high in fat or protein.⁵ Adherence to this guideline is improved when patients are allowed to consume clear fluids closer to the time of the procedure.^{2,3,6}

One of the primary recommendations from ESAIC is to encourage adults to consume clear fluids - such as water, tea or coffee without milk, or pulp-free juice - up to two hours before elective surgery. For children, clear fluid intake is permitted up to one hour prior to the induction of anaesthesia.^{1,6} Alcohol is excluded from this recommendation. Evidence supports the safety of clear fluid intake, highlighting its role in reducing patient discomfort and improving well-being.²⁻⁴

Additionally, chewing gum or sucking on a boiled sweet immediately before anaesthetic induction should not result in the cancellation or delay of surgery.

ONE OF THE PRIMARY RECOMMENDATIONS FROM ESAIC IS TO ENCOURAGE ADULTS TO CONSUME CLEAR FLUIDS - SUCH AS WATER, TEA OR COFFEE WITHOUT MILK, OR PULP-FREE JUICE - UP TO TWO HOURS BEFORE ELECTIVE SURGERY

Studies indicate that gastric fluid volume and pH levels are not significantly elevated in such cases compared to those who abstained. Conversely, smoking prior to surgery has been associated with increased gastric fluid volumes and more acidic gastric pH levels, making it advisable to discourage smoking before elective surgical procedures. Factors such as oesophageal reflux, diabetes, obesity, and pregnancy, which delay gastric emptying, do not necessarily warrant deviations from these fasting guidelines. However, these conditions may require adjustments in overall anaesthetic management.^{2,3,4,6,7}

The results of this research highlight the fact that while the general public understands the importance of adequate preoperative fasting as part of the perioperative process, their awareness may not reflect current practice. It is essential for healthcare professionals to remain informed about updated fasting recommendations and ensure they provide patients with up-to-date information and mitigate the complications arising from extended fasting periods. Enhancing both staff and patient knowledge can significantly improve safety and optimize the perioperative experience.⁷

Several factors contribute to non-adherence to fasting guidelines, including inadequate staff knowledge, inconsistent or insufficient patient instructions, patient anxiety, and changes in operating room schedules.⁸ Many patients are still instructed to remain 'nil by mouth' from midnight before elective surgery, which often leads to unnecessarily prolonged fasting, particularly for patients scheduled for afternoon procedures.⁹ To address this, preoperative assessments should include comprehensive patient education, incorporating both verbal and written information, and a 'Sip til Send' protocol should be implemented and reinforced. A 'Sip til Send' protocol allows patients to consume clear liquids until the time of being sent to the operating theatre.⁷ This approach is pivotal in improving patient understanding, satisfaction, and compliance with fasting protocols.^{5,10,11}

Implementing standardized algorithms for staff to improve coordination and communication across theatres, wards, and admission areas, has proven successful in enhancing adherence to fasting guidelines in centres abroad. Furthermore, additional procedural improvements could be implemented, such as providing clear fluids to patients in the early morning if they are not scheduled for the first time slot in the operating theatre.¹¹ These strategies emphasize the importance of efficient perioperative care and underscore the need for systemic changes to eliminate outdated practices, such as prolonged

fasting, and thus ensure alignment with evidence-based recommendations.^{3,5,9,10,11}

CONCLUSION

This audit concludes that, amongst a sample of the general public, there is a general awareness of the current fasting guidelines and the rationale behind why patients are asked to fast before elective surgery. However, there remains a significant need for further education and awareness on this matter. It is particularly noteworthy that many participants demonstrated an understanding of the distinction between fasting requirements for solids and clear fluids, despite this practice still not being implemented locally. This should primarily be addressed at the Pre-Operative Assessment Clinic, but efforts should also be made to improve communication with patients across all clinical settings.

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REFERENCES

1. Schmitz A, Kuhn F, Hofmann J, et al. Incidence of adverse respiratory events after adjustment of clear fluid fasting recommendations to 1 h: a prospective, observational, multi-institutional cohort study. *Br J Anaesth* 2024;132(1):66-75.
2. Sidik AI, Faybushevich AG, Hossain ML, et al. Enhancing Compliance With Preoperative Fasting Guidelines: A Closed-Loop Quality Improvement Initiative to Optimize Patient Safety and Outcomes. *Cureus* 2024;16(12):e75250.
3. Sidik AI, Lishchuk A, Faybushevich AN, et al. Adherence to Preoperative Fasting Guidelines in Elective Surgical Patients. *Cureus*. 2024;16(10):e71554.
4. Rüggeberg A, Meybohm P, Nickel EA. Preoperative fasting and the risk of pulmonary aspiration-a narrative review of historical concepts, physiological effects, and new perspectives. *BJA Open* 2024;10:100282.
5. Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures: An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. *Anesthesiology*. 2017;126(3):376-393.
6. Smith I, Kranke P, Murat I, et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. *Eur J Anaesthesiol* 2011;28(8):556-69.
7. Marsman M, Kappen TH, Vernooij LM, et al. Association of a Liberal Fasting Policy of Clear Fluids Before Surgery With Fasting Duration and Patient Well-being and Safety. *JAMA Surg* 2023;158(3):254-263.
8. Silva Júnior RER, Soriano CA, Lima PAS, et al. Beyond Guidelines: The Persistent Challenge of Preoperative Fasting Times. *Surgeries* 2023; 4(4):611-622.
9. Beck MH, Balci-Hakimeh D, Scheuerecker F, et al. Real-World Evidence: How Long Do Our Patients Fast? - Results from a Prospective JAGO-NOGGO-Multicenter Analysis on Perioperative Fasting in 924 Patients with Malignant and Benign Gynecological Diseases. *Cancers (Basel)* 2023;15(4):1311.
10. Alshurtan KS, Elsaid RM, Alabdulaali AK, et al. Community's knowledge and attitude of pre-operative fasting in kingdom of Saudi Arabia, 2022. *Signa Vitae* 2023;19(6):127-136.
11. Witt L, Lehmann B, Sümpelmann R, et al. Quality- improvement project to reduce actual fasting times for fluids and solids before induction of anaesthesia. *BMC Anesthesiology* 2021;21(1):254.

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HEALTH

Located within DaVinci Health, The Movement School Malta (TMSM) is the only Certified Clinic in Malta of The Running and Movement School UK. The author of this article is also an international partner of the franchise owner Mike Antoniadis.

TMSM is a premier Physiotherapy, Rehabilitation and Performance center specializing in movement reprogramming and brain rewiring through a specific patented method of exercise therapy. We help individuals refine and enhance their neuromuscular efficiency by stimulating neural pathways. By challenging the proprioceptive system and optimizing kinetic chain engagement, we promote better synchronization and faster motor unit activation. This leads to reduced pain, improved motor patterns, and enhanced overall performance.

During the initial assessment of a patient, we conduct our standard physiotherapy clinical examination and differential diagnosis alongside our patented evaluations, including the Dynamic Movements Skills (DMS), Functional Movement Analysis (FMA) and a detailed walking and running analysis. The DMS and FMA, developed by the Movement and Running School in the United Kingdom, are designed to enhance and refine gross motor skills, coordination, agility, and quickness while also providing insight into the brain's cross-lateral activation and overall movement maps based on previous injury and movement history.

For the purpose of clarity and simplicity, the following are three case studies to understand our rehabilitation approach.

1. A 9-year-old girl who had 70% of her cerebellum removed due to a tumor came to us just twenty days after her surgery in England. Her discharge report noted right-sided ataxia affecting both her upper and lower body, reduced reading comprehension, decreased fluency, and impaired movement recall compared to her pre-operative abilities.

The assessment revealed deficiencies in cross-lateral activation (inability to control Lt arm with Rt leg with trunk control and vice versa), along with poor dynamic core engagement, balance, and coordination. These issues were particularly pronounced on the right side, where a lack of proprioception was most evident.

Moreover, the walking analysis confirmed:

- The right-sided ataxia
- No coordination
- Forward posture
- Poor cross-lateral activation
- No upper body engagement
- Right arm frontal plane swing
- Right-sided ankle end-range flick
- Little lower body dynamic balance
- Midline crossover



The rehabilitation program focused on several key elements: cross-lateral activation, total body coordination, correct gait mechanics, Central Nervous System (CNS) stimulation, hand/eye coordination, and movement re-patterning. Integrated into the sessions, speech was also stimulated with a focus on fluency and recall capacity. Throughout the process, double and triple-tasking were added over time to increase difficulty while stimulating multitasking abilities. The young girl came four to five times a week, for one-hour sessions for six straight weeks. The program frequency was purposefully high, to stimulate **neuroplasticity** and movement re-patterning.

More recently, she has been attending our program twice a week since returning to school full-time. We continuously challenge her brain and body, to ensure as smooth of a transition as possible into everyday activities. **Improvements are very evident and the key factor of this rare but very real case is the importance and belief in the brain's power to regenerate and reinvent itself.** We have also been involved in her educational process, assisting the school through explaining and helping them understand the unique needs of this young girl.

Rather than allowing this young girl to go through growth with the deficiency of cerebellar control, we are enhancing the 30% remaining portion of her cerebellum and the rest of her brain to perform the highly automated functions of the cerebellum. This young girl is now managing to run, a task which is considered to be impossible without the filtering power of the cerebellum.



2. Mrs X, a 55-year-old woman with a longstanding history of diabetes, was suffering for over 5 years with plantar fasciitis in both feet alongside severe back pain. All available imaging modalities alongside multiple infiltrations, pain medication, multiple PRP injections, physiotherapy sessions including shockwave, nerve blocks and orthotics did not help this patient get better. Mrs X came in contact with our services. All interventions performed and attempted led to a worsening antalgic gait pattern which was mapped in her brain and peripheral nervous system. All this was the reason for her persistent back and heel pain.

The pain she was feeling and constant interventional attempts to block afferent sensory stimuli resulted in catastrophic brain map chaos. Centralised motor activation as a result of the constant pain was not functioning properly resulting in poor movement processing.

Brain rewiring and movement re-patterning is what TMSM works on through lengthy individualised sessions. Mrs X eventually walked out pain-free with a renewed sense of independence and hope. Five years down the line she is still pain-free and constantly seeks our services in the management of other ongoing but different health issues. Neural activation through exercises, backwards walking, and training the firing sequence of muscle groups in the correct order is what helped rewire the brain and lead to a pain-free gait.

'Movement is the Universal Language of Freedom' and 'Movement is Therapy' are common motivational statements used during our sessions. Movement is initiated from the brain based on what it receives from all our senses, and most importantly from our proprioceptive nervous system, which is largely considered to be our 6th sense. It is very easy to forget that the brain must be seen as the focus of rehabilitation rather than the distal specific body part. Brain rewiring, motor repatterning, and exercising the nervous system are how we generate change through the commonly but poorly understood term neuroplasticity.

3. A 16-year-old 400m sprinter presented with a bone bruise in his left fibula. His training load had been intense since the age of 12. Functional Movement Assessment (FMA) revealed a training bias toward the anterior chain, accompanied by poor hip stability, ankle instability, incorrect muscle firing sequences, and significant hip tightness.

Running Analysis Findings:

- Strong ankle inversion on landing
- Leg crossing the midline
- Ankle external rotation
- Bilateral hip drop
- Lack of dynamic core anti-rotation

REHABILITATION STRATEGY

OFFLOADING PHASE

During the initial offloading period, the focus was on maintaining upper body strength and coordination to preserve athletic capacity while reducing lower limb stress.

LOADING PHASE

As the athlete progressed into the loading phase, we shifted focus toward posterior chain activation and unilateral strength development. Exercises were designed to drive central nervous system (CNS) stimulation and re-establish neural coordination while stimulating fast motor patterning.

A major goal was to leverage neuroplasticity

- the brain's ability to reorganize itself -to retrain the nervous system in recognizing and utilizing the posterior chain effectively. This reprogramming was essential for restoring strength, enhancing stability, and correcting dysfunctional movement patterns critical to sprinting at an average pace of 33 km/h.

Stress fractures are typically a result of repetitive overload, often due to poor biomechanics and overtraining. In this case, instability at the ankle led to compensatory loading of the tibia and fibula, forcing them to absorb more force than they were structurally equipped to handle.

After weeks of dedicated training, his running showcased strong kinetic chain coordination, marked by solid ankle and hip stability. His hard work paid off when he qualified for the Youth European Championships and performed very well.

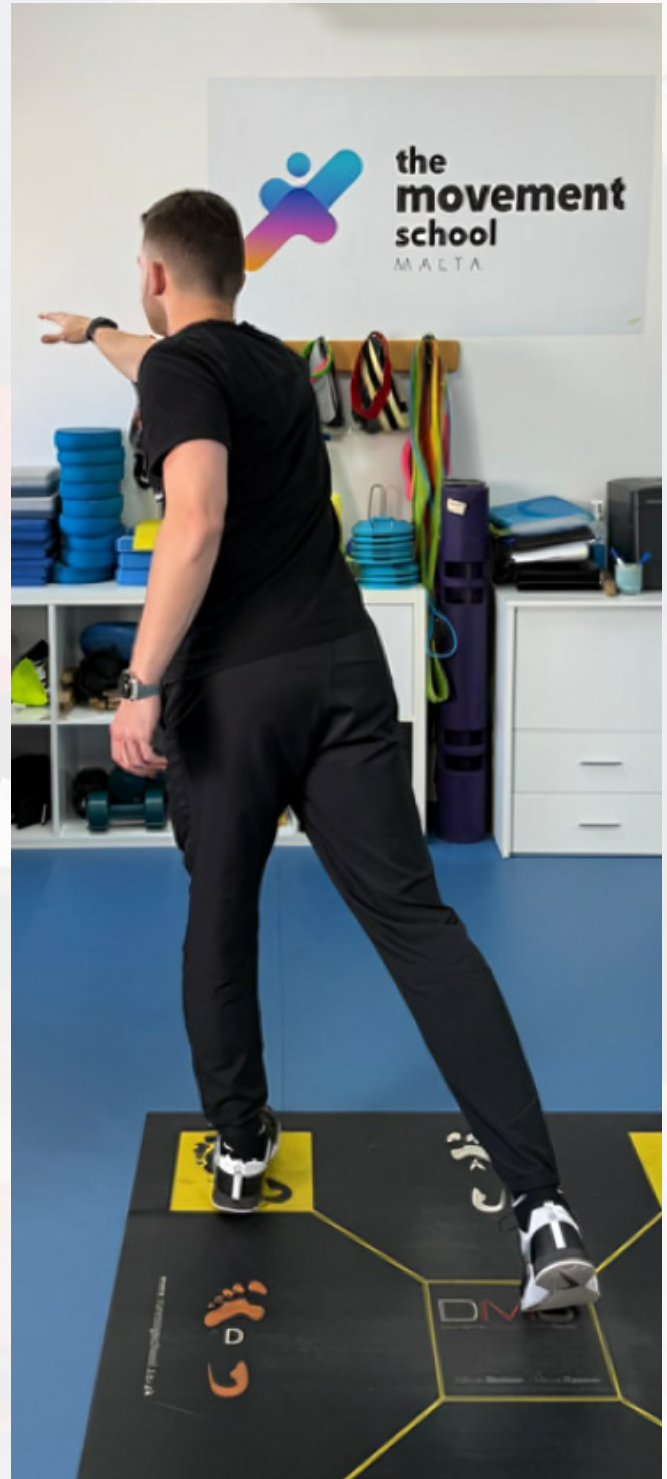
THE ROLE OF NEUROPLASTICITY IN REHABILITATION

Our methodology places a strong emphasis on neuroplasticity - the brain's ability to adapt and form new neural connections. This concept, championed by Dr Michael Merzenich, has transformed our understanding of rehabilitation. Previously dismissed in traditional medical circles, neuroplasticity is now recognized as a vital mechanism in injury recovery, performance optimization, and chronic pain treatment.

For those interested in exploring this transformative concept, Dr Merzenich's book *Soft-Wired: How the New Science of Brain Plasticity Can Change Your Life* is an excellent resource.

Neuroplasticity is only beginning to gain traction in the rehabilitation world. Consider these phrases: *Exercising the brain. The brain is not a muscle.*

Yet, by tapping into its plastic nature, we can initiate central changes that impact peripheral outcomes. This approach holds promise not only for pain relief and injury recovery but also for enhancing athletic performance and unlocking human potential beyond perceived limits.





MRI of Rotator Cuff Tendon Tears – An Introduction

Part 2: Description and Relevant Associated Findings

ABSTRACT

The commonest clinical indication for referring a patient to undergo shoulder magnetic resonance imaging is a suspicion of possible rotator cuff injury. In addition to diagnosing the presence or otherwise of an actual tear and assessing the surrounding soft tissue and skeletal structures, the radiologist's role is to convey diagnostically and prognostically useful information that helps referring clinicians devise optimal management plans for their patients. A short description of how MR imaging of the shoulder is acquired, in addition to relevant MR rotator cuff tendon anatomy, was the focus of part 1, whereas this article shall describe rotator cuff tendon tears in detail.

KEYWORDS

Shoulder, Magnetic resonance imaging (MRI), Radiology, Rotator cuff, Tendon

INTRODUCTION^{1,2}

Rotator cuff tendon tears (RCTs) may be either acute or chronic; acute tears are classically seen following a fall or lifting of heavy objects, whereas chronic tears are usually set against a background of intrinsic degeneration and mechanical stresses, with or without adjacent inflammatory changes.

A study performed more than 30 years ago showed that over 95% of torn rotator cuff tendons demonstrated histological evidence of tissue degeneration.²

Genetic factors (eg. family history), as well as environmental ones (eg. smoking, hyperlipidaemia), are also thought to play a role, potentially via a deleterious effect on the tendon microvasculature.³

CLASSIFICATION – TEARS AND ASSOCIATED FINDINGS

RCTs may also be defined by their thickness and extent.⁴⁻⁶ A partial-thickness (PT) tear (Fig. 1) may be articular-sided, bursal-sided or interstitial/intrasubstance in nature. By definition, PT tears do not allow communication between the glenohumeral joint space and the subacromial-subdeltoid bursa.

High-grade tears (i.e. those involving greater than 50% of tendon thickness) have a 55% chance to progress to full thickness (FT), whereas low-grade tears (those involving less than 50% of tendon thickness) have only a 14% chance of progression.⁷

Articular-sided tears tend to be commoner with respect to bursal-sided ones (3:1), with recent studies showing that intrasubstance tears may nevertheless be the commonest ones.⁴

Bursal-sided tears also tend to be more painful, thereby tending to present earlier clinically.

ROTATOR CUFF TENDON TEARS (RCTS) MAY BE EITHER ACUTE OR CHRONIC; ACUTE TEARS ARE CLASSICALLY SEEN FOLLOWING A FALL OR LIFTING OF HEAVY OBJECTS, WHEREAS CHRONIC TEARS ARE USUALLY SET AGAINST A BACKGROUND OF INTRINSIC DEGENERATION AND MECHANICAL STRESSES, WITH OR WITHOUT ADJACENT INFLAMMATORY CHANGES

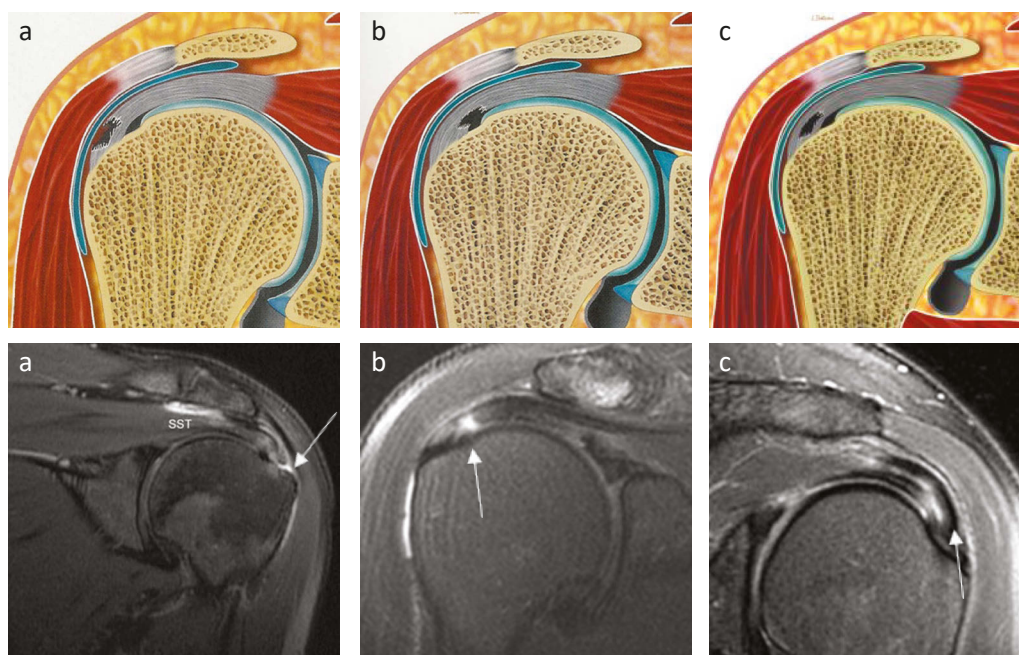


Figure 1. PT tears, diagrammatic (first row) and MRI (second row) representation. a - bursal-sided, b - articular-sided, c - interstitial.^{5,8,9}

PT tears may or may not involve the tendon insertion (Fig. 2), leading to various subtypes (eg. PASTA (Partial Articular Supraspinatus Tendon Avulsion)/ rim-vent lesion affecting the supraspinatus tendon footplate, whereas a PAINT (Partial Articular-sided tear with INTratendinous extension) lesion affects the non-insertional articular fibres as well as showing an interstitial component).

Classically, PT tears will show up on MRI as fluid-filled foci within tendon tissue.

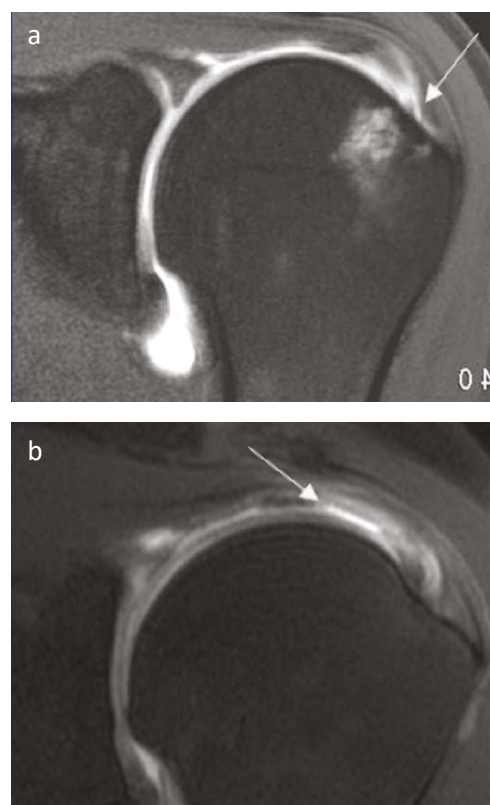
Interstitial tears¹⁰ propagate along the path of least resistance between the collagen fibres (between layers II and III), resulting in cuff delamination. They tend to propagate in a horizontal fashion along the tendon's long axis, and may coexist with a bursal or articular-sided component.

Pure interstitial tears do not communicate with either tendon surface, hence being arthroscopically invisible, leading to the recently coined term 'concealed interstitial delaminating' (CID) lesion.

Overall accuracy of MRI for PT tears is less than that for FT tears. This may be secondary to the formation of granulation/scar tissue within the tendon defect, as well as the relative absence of peritendinous fluid.

Articular-sided, PT tears that coexist with interstitial components may contribute to the development of sentinel cysts.¹⁰⁻¹² These are clinically silent entities, seen in approximately 1% of RCTs, be they PT or FT in nature (Fig. 3).

Figure 2. Examples of PT tendon tears on selected coronal oblique fat-saturated (FS) T1-weighted MR arthrography images.¹⁰ a – PASTA lesion, b – PAINT lesion.



Articular fluid enters the delaminating component of the tear via a ball-valve mechanism, leading to cyst development. The cysts tend to be oriented parallel to the long axis of the involved muscle, and may develop within a different, otherwise intact myotendinous unit.

FT tears, by definition, allow communication between the glenohumeral articular and subacromial-subdeltoid spaces. They are best evaluated on fluid-sensitive sequences (with/out fat signal suppression) and evaluated in at least two planes (usually coronal and sagittal, Fig. 4).

The most common appearance of a FT tear is high signal intensity on a fluid-sensitive sequence that extends from the articular surface of the rotator cuff to the subacromial-subdeltoid space. This is the finding observed in approximately 90% of FT tears proven at surgery.¹³

In chronic RCTs in which the shoulder joint has little or no effusion, the humeral head may be high-riding,

with not much high signal being identified at the tear site. Fibrous thickening of the subacromial-subdeltoid bursa may develop in a few patients with chronic tears. This may mimic an intact tendon in the absence of an effusion and may lead to misdiagnosis. In the case of acute RCTs, blood products principally platelet-rich plasma may sometimes mimic some intact fibers, another potential diagnostic pitfall.

FT tears don't heal on their own: without treatment, they tend to progress, causing fatty infiltration and atrophy of the corresponding muscle bellies, altered shoulder dynamics and ultimately osteoarthritis.¹³

The sagittal plane dimensions of RCTs determine whether they are small (<1cm), medium sized (1-3cm), large (>3-5cm), or massive (>5cm).^{14,15} It is very important to assess for integrity or otherwise of the overlying deltoid musculotendinous unit, with injuries of the latter entity being associated with massive, FT RCTs.¹⁶

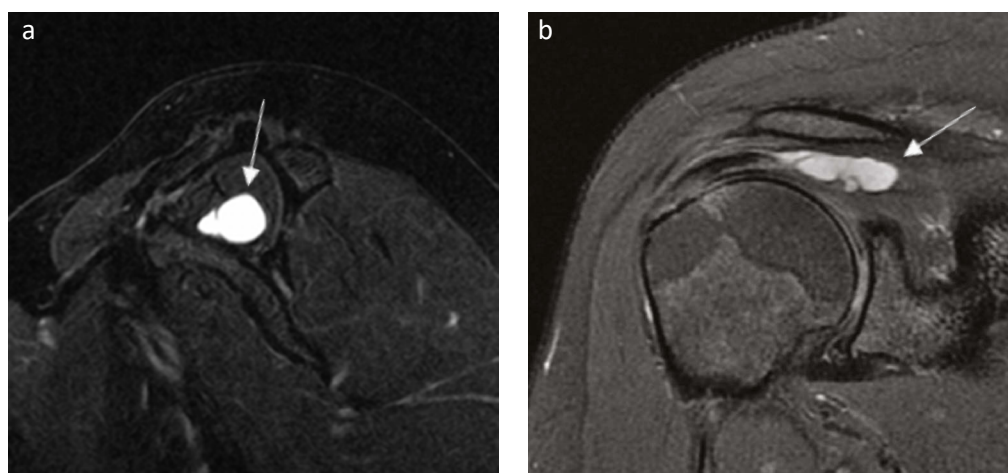


Figure 3. Sagittal (a) and coronal (b) oblique images showing a lobulated intramuscular cyst within the supraspinatus muscle belly.^{11,12}

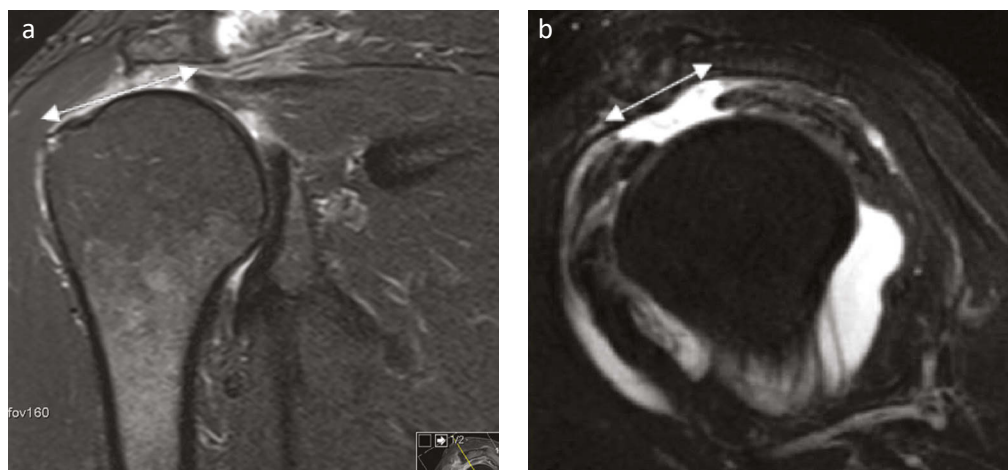


Figure 4. Two-plane evaluation (a-coronal, b-sagittal) of a FT supraspinatus insertional tendon tear (double-headed arrows).¹¹

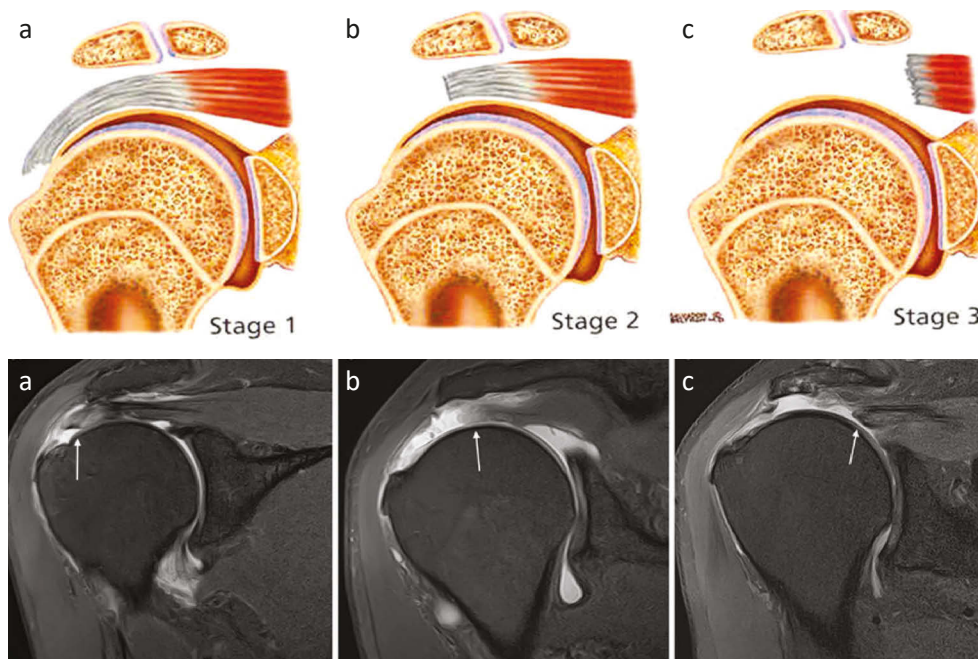
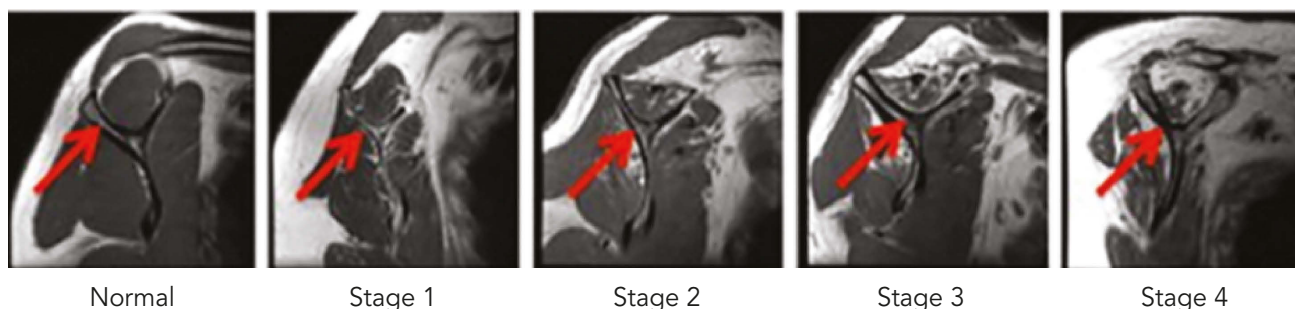


Figure 5. Supraspinatus FT tendon tears, different stages of retraction. Diagrammatic representation (first row), and coronal oblique MR arthrography images (second row).^{6,17}

Stage 1, minor retraction;
Stage 2, retraction up to the vertex of the humeral head;
Stage 3, retraction over the superior glenoid margin.

Figure 6. Different stages of muscle volume/fatty infiltration seen on sagittal oblique T1-weighted imaging, as per Goutallier classification.²¹



The degree of tendon retraction in the coronal plane (Fig. 5) also needs to be determined:¹⁷

Stage I - little retraction of the proximal tendon stump.

Stage II - retraction of the stump up to the apex of the humeral head.

Stage III - retraction of the tendon to the level of the glenohumeral joint line.

Longstanding FT RCTs can result in muscle atrophy and fatty infiltration, thereby preventing successful surgical repair. Various methods for muscle atrophy evaluation on MRI have been described in the radiology literature, in view of the fact that fatty degeneration is an important predictive factor for surgical outcome, especially at the infraspinatus level.¹⁸⁻²⁰ This tends to develop more quickly and more severely in larger, FT tendon tears.

The Goutallier classification system, originally utilized for CT imaging¹⁹ and then validated for MRI,²⁰ is universally utilised for staging (Fig. 6):

Stage 0 Normal

Stage 1 Minimal fatty streaking

Stage 2 Muscle>fat

Stage 3 Muscle=fat

Stage 4 Fat>Muscle

The 'tangent' sign²²⁻²⁴ and 'occupation ratio'²³ are amongst the most commonly used methods that help quantify the degree of atrophy and fatty degeneration present in muscles. A positive tangent sign (Fig. 7) is present when a line drawn across the roof of the supraspinous fossa fails to intersect through the supraspinatus muscle belly.²⁴ This tends to be seen

Figure 7. Selected sagittal oblique proton density FS (PD-FS) images.²²

- a - Negative tangent sign: red line drawn across the roof of the supraspinous fossa intersects a normal-volume supraspinatus muscle belly,
 b - Positive tangent sign: red line drawn across the roof of the supraspinous fossa fails to intersect an atrophic supraspinatus muscle belly.²

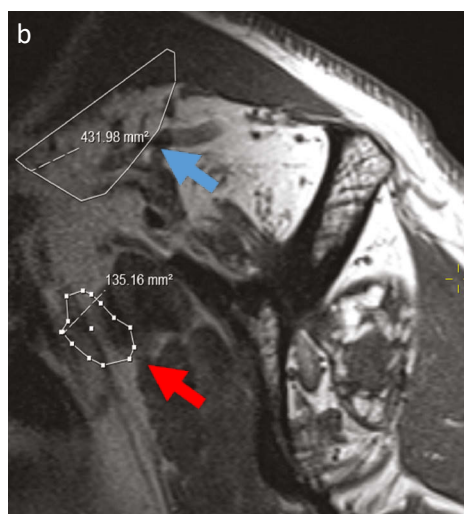
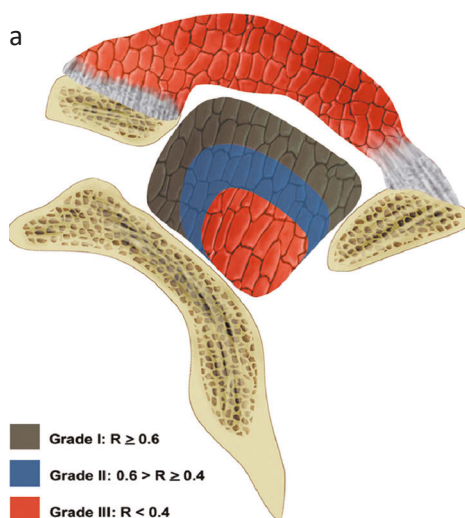
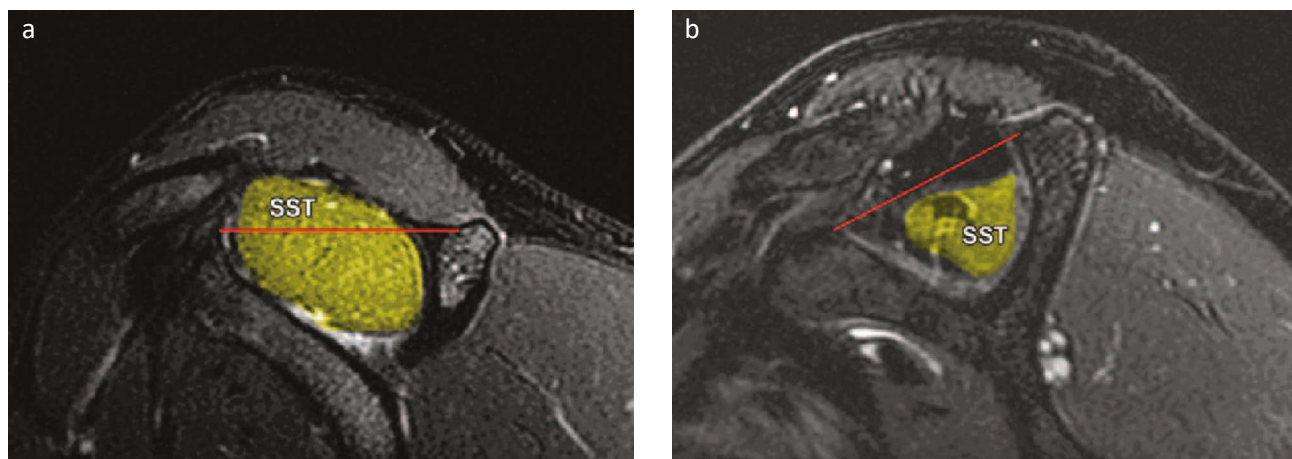


Figure 8.

- a - Diagrammatic representation of the occupation ratio.
 b - Significant atrophy of the supraspinatus muscle belly (red arrow), relative to the supraspinous fossa cross-sectional area (blue arrow).²³

between 4-5 years after a FT RCT, and is a useful predictor of whether a tear is surgically repairable or not.

Thomazeau and colleagues²³ proposed the occupation ratio (Fig. 8), whereby the cross-sectional area of the muscle is divided by the cross-sectional area of the supraspinous fossa. A normal value is a ratio of 0.6 or above, with one that is less than 0.4 signifying severe atrophy.

Both of these two methods need to be carried out medially, because of possible significant medial muscle belly retraction following a FT tear, leading to potential errors.²²

A NORMAL [OCCUPATION RATIO] VALUE IS A RATIO OF 0.6 OR ABOVE, WITH ONE THAT IS LESS THAN 0.4 SIGNIFYING SEVERE ATROPHY

OTHER FACTORS TO CONSIDER WHEN REPORTING RCTS

Humeral head migration/acromiohumeral interval (AHI, Fig. 9)²⁵

Acromial morphology (Fig. 10):²⁶ downsloping (coronal images) or inferiorly hooking (sagittal images); lateral subacromial bony spurs measuring > 5mm in size have been associated with tear development.

Persistent os acromiale (Fig. 10):²⁷ relevant in the adult population, given the associated dynamic instability as well as the development of underlying bony spurs.

Acromioclavicular (AC) joint morphology - undersurface marginal osteophytes may contribute towards mechanical impingement.²⁸

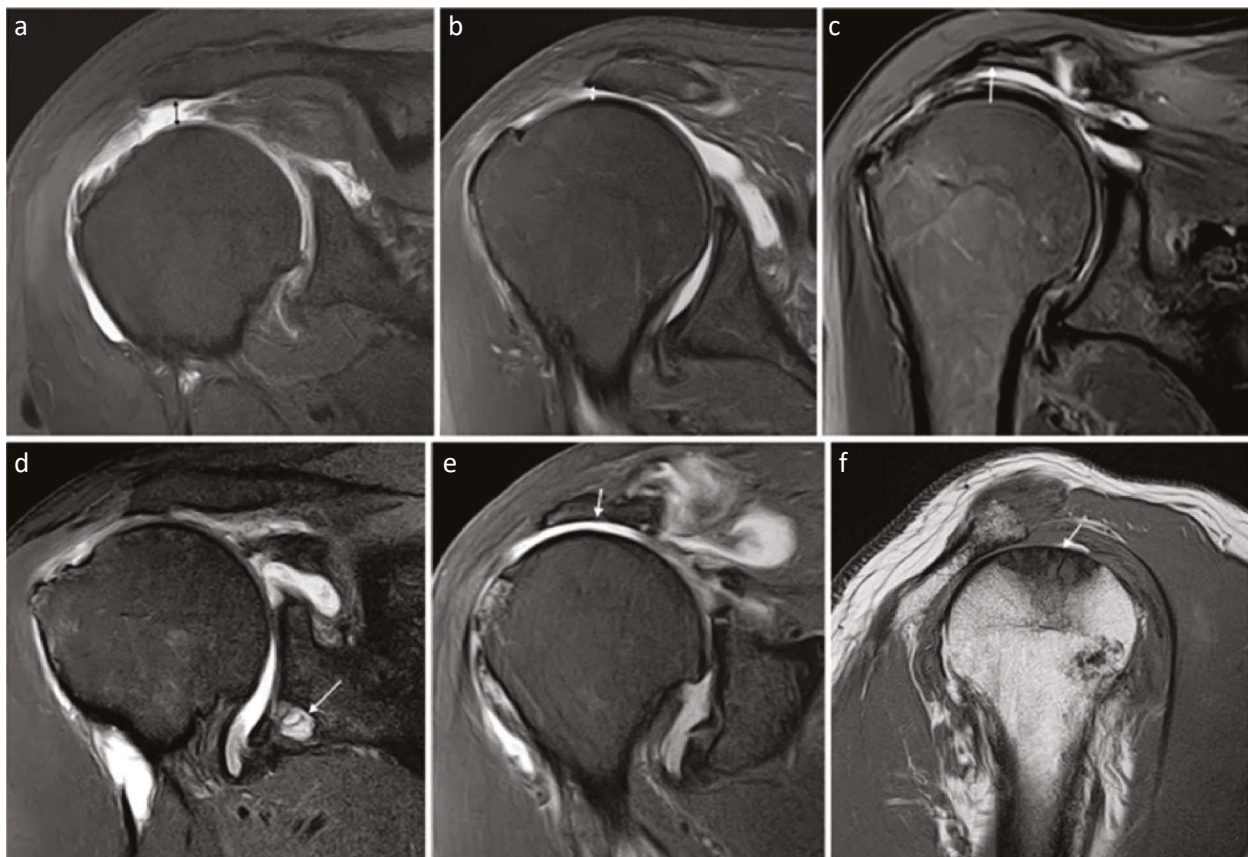
Labral morphology/tears- paralabral pseudocysts arising from glenoid labral tears may contribute to cuff muscle denervation and potential instability, in addition to clinical weakness.

Long head of biceps (LHB) tendon - location (medialisation relative to the subscapularis footplate) and morphology (may be torn in conjunction with large/ massive RCTs).²⁸

Figure 9. Hamada rotator cuff arthropathy stages of evolution.^{18,25} Coronal oblique PD-FS (a-e), sagittal oblique T1-weighted (f) images.

- a - Stage 1 AHI > 5mm (double-headed arrow).
- b - Stage 2 AHI < 5mm (double-headed arrow).
- c - Stage 3 AHI plus acetabularised acromial undersurface (arrow).
- d - Stage 4a - same as stage 2 but with accompanying glenohumeral degeneration (arrow).
- e - Stage 4b - as 4a plus acetabularised acromial undersurface (arrow).
- f - Stage 5 - osteonecrosis at the humeral head apex (arrow).

The term 'acetabularization', as described by Hamada et al., refers to an excavating deformity of the acromion undersurface or an excessive spur deformity along the coracoacromial ligament.



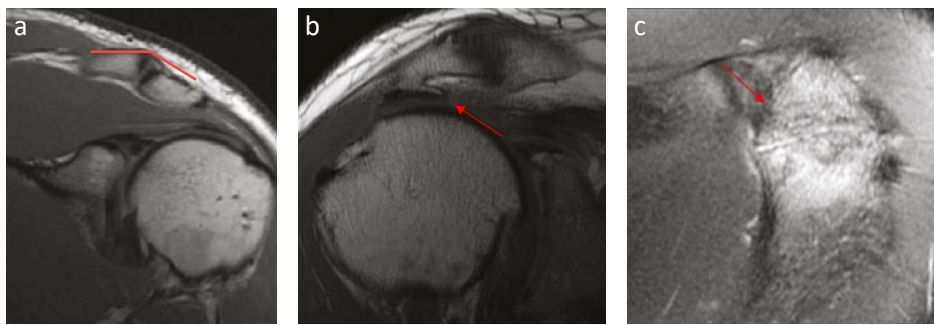


Figure 10^{5,12}.
a - Laterally downsloping acromion.
b - Prominent subacromial 'keel' osteophyte (red arrow).
c - Os acromiale with florid subarticular marrow oedema-like signal changes (red arrow).

SUMMARY: WHAT THE SURGEON NEEDS TO KNOW²⁹

- Type, Location of tear
- Size (2 planes)
- Muscle Atrophy/fatty infiltration
- Chronicity (implies the presence of a less compliant tendon)
- Quality of tissues (tendon stump resorption; fibrillated tendon edges)
- Elevation of Humeral Head/? cuff arthropathy
- Acromial Morphology
- Status of LHB Tendon

CONCLUSION

RCTs are a common, significant cause of pain and reduced mobility, varying in size, location, pattern, functional impairment, and potential reparability. Radiological findings of RCTs have a decision-making impact on patients, depending on the factors outlined above. It is therefore up to the radiologist to deliver a meaningful report that is useful to the referring clinician, thereby assisting in optimal treatment selection.

REFERENCES

- Clark JM, Harryman DT 2nd. Tendons, ligaments, and capsule of the rotator cuff. *J Bone Joint Surg Am* 1992; 74:713–725.
- Kannus P, Jozsa L. Histopathological changes preceding spontaneous rupture of a tendon: a controlled study of 891 patients. *J Bone Joint Surg Am* 1991;73:1507–25.
- Song A, Cannon D, Kim P, et al. Risk factors for degenerative, symptomatic rotator cuff tears: a case-control study. *J Shoulder Elbow Surg* 2022;31(4):806–812.
- Chang EY, Chung CB. Current concepts on imaging diagnosis of rotator cuff disease. *Seminars in Musculoskeletal Radiology* 2014;18(4):412–24.
- Stoller DW. Stoller's Orthopaedic and Sports Medicine: The Shoulder. Rotator Cuff Tears (Chapter 6). Lippincott Williams and Wilkins, 2014.
- Toyoda H, Ito Y, Tomo H, Nakao Y et al. Evaluation of rotator cuff tears with magnetic resonance arthrography. *Clinical Orthopaedics and Related Research* 2005;439:109–15.
- Vecchini E, Ricci M, Elena N, et al. Rotator cuff repair with single row technique provides satisfying clinical results despite consistent MRI retear rate. *J Orthop Traumatol* 2022;23(1):23.
- Saifuddin A, Tyler P, Hargunani R. Musculoskeletal MRI. 2nd ed. The Shoulder Girdle (Chapter 1). CRC Press (Routledge), 2016.
- Sanders TG, Tirman PF, Feller JF et al. Association of intramuscular cysts of the rotator cuff with tears of the rotator cuff: MRI findings and clinical significance. *Arthroscopy* 2000;16(3):230–5.
- Pope T, Bloem HL, Beltran J, et al. Imaging of the Musculoskeletal System: Expert Radiology Series. Shoulder Impingement Syndromes (Chapter 8). Saunders, 2008.
- Walz DM, Miller TT, Chen S et al. MR imaging of delamination tears of the rotator cuff tendons. *Skeletal Radiology* 2007;36(5):411–6.
- Manvar AM, Kamireddi A, Bhalani SM et al. Clinical significance of intramuscular cysts in the rotator cuff and their relationship to full- and partial-thickness rotator cuff tears. *AJR Am J Roentgenol* 2009;192(3):719–24.
- Rafii M, Firooznia H, Sherman O et al. Rotator cuff lesions: signal patterns at MR imaging. *Radiology* 1990;177(3):817–23.
- Tempelaere C, Pierrat J, Lefèvre-Colau MM et al. Dynamic Three-Dimensional Shoulder MRI during Active Motion for Investigation of Rotator Cuff Diseases. *PLoS One* 2016;11(7):e0158563.
- De Orio JK, Cofield RH. Results of a second attempt at surgical repair of a failed initial rotator-cuff repair. *J Bone Joint Surg Am* 1984;66(4):563–567.
- Moser T, Lecours J, Michaud J et al. The deltoid, a forgotten muscle of the shoulder. *Skeletal Radiology* 2013;42(10):1361–75.
- Patte D. Classification of rotator cuff lesions. *Clin Ortho Rel Res* 1990;(254):81–6.
- Yubran AP, Pesquera LC, Juan ELS et al. Rotator cuff tear patterns: MRI appearance and its surgical relevance. *Insights Imaging* 2024;15(1):61.
- Goutallier D, Postel JM, Bernageau J et al. Fatty muscle degeneration in cuff ruptures. Pre- and postoperative evaluation by CT scan. *Clin Orthop Relat Res* 1994;(304):78–83.
- Fuchs B, Weishaupt D, Zanetti M et al. Fatty degeneration of the muscles of the rotator cuff: assessment by computed tomography versus magnetic resonance imaging. *J Shoulder Elbow Surg* 1999;8:599–605.
- Nardo L, Karampinos DC, Lansdown DA et al. Quantitative assessment of fat infiltration in the rotator cuff muscles using water-fat MRI. *J Magn Reson Imaging* 2014;39(5):1178–85.
- Morag Y, Jacobson JA, Miller B et al. MR imaging of rotator cuff injury: what the clinician needs to know. *Radiographics* 2006;26(4):1045–65.
- Thomazeau H, Boukobza E, Morcet N et al. Prediction of rotator cuff repair results by magnetic resonance imaging. *Clin Orthop Relat Res* 1997;(344):275–283.
- Kissenberth MJ, Rulewicz GJ, Hamilton SC et al. A positive tangent sign predicts the reparability of rotator cuff tears. *JSES* 2014;23(7):1023–7.
- Hamada K, Yamanaka K, Uchiyama Y et al. A Radiographic Classification of Massive Rotator Cuff Tear Arthritis. *Clin Orthop Relat Res* 2011;469(9):2452–60.
- McGinley JC, Agrawal S, Biswal S. Rotator cuff tears: association with acromion angulation on MRI. *Clinical Imaging* 2012;36(6):791–6.
- Winfeld M, Rosenberg ZS, Wang A et al. Differentiating os acromiale from normally developing acromial ossification centres using magnetic resonance imaging. *Skeletal Radiology* 2015;44(5):667–72.
- Tuite MJ. Magnetic resonance imaging of rotator cuff disease and external impingement. *Magnetic resonance imaging Clinics of North America* 2012;20(2):187–200, ix.
- Hawkins RJ. Diagnosis and Treatment of Impingement. Proceedings of the Current Issues of MRI in Orthopaedics & Sports Medicine Conference; August 24th 2003; San Francisco, USA.



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