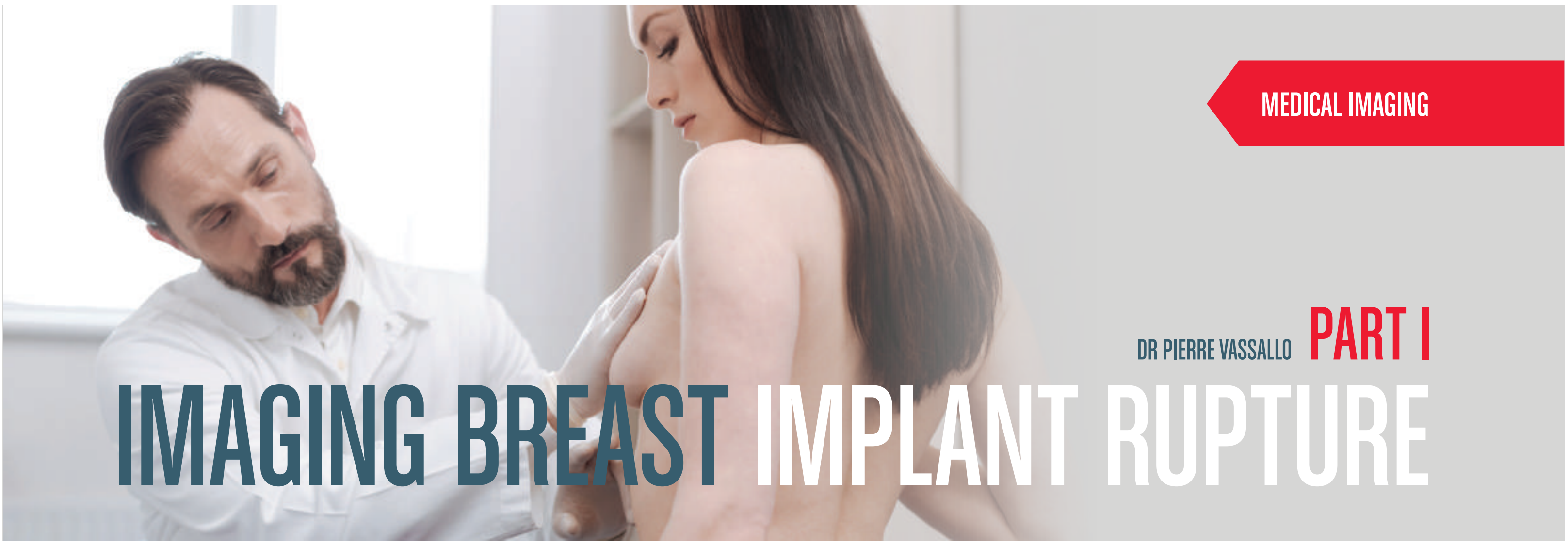
REFERENCES

1. Breeman WA, De Jong MT, De Blois E, Bernard BF, De Jong M, Krenning EP. Reduction of skeletal accumulation of radioactivity by co-injection of DTPA in [90Y-DOTA0,Tyr3]octreotide solutions containing free 90Y3+. Nuclear medicine and biology. 2004;31(6):821-4.
2. Kitajima A, Ogawa H, Kobayashi T et al. Monitoring low-radioactivity caesium in Fukushima waters. Environmental science Processes & impacts. 2014;16(1):28-32.
3. Kunii Y, Uruno T, Mukasa K et al. Inhibitory effect of low-dose inorganic iodine on thyroidal radioactive iodine uptake in healthy Japanese adults. Endocr J. 2016;63(1):21-7.
4. Verger P, Aurengo A, Geoffroy B, Le Guen B. Iodine kinetics and effectiveness of stable iodine prophylaxis after intake of radioactive iodine: a review. Thyroid : official journal of the American Thyroid Association. 2001;11(4):353-60.
5. Zanzonico PB, Becker DV. Effects of time of administration and dietary iodine levels on potassium iodide (KI) blockade of thyroid irradiation by 131I from radioactive fallout. Health physics. 2000;78(6):660-7.
6. MacVittie TJ, Bennett AW, Farese AM et al. The Effect of Radiation Dose and Variation in Neupogen(R) Initiation Schedule on the Mitigation of Myelosuppression during the Concomitant GI-ARS and H-ARS in a Nonhuman Primate Model of High-dose Exposure with Marrow Sparing. Health physics. 2015;109(5):427-39.
7. Did you know? Prussian blue dye. Consumer reports. 2004;69(1):45.
8. Sasaki K, Morikawa H, Kishibe T et al. Practical removal of radioactivity from soil in Fukushima using immobilized photosynthetic bacteria combined with anaerobic digestion and lactic acid fermentation as pre-treatment. Biosci Biotechnol Biochem. 2012;76(9):1809-14.
9. Brooksbank RE, Browder FN, Holcomb RR, Whitson WR. Low-Radioactivity-Level Waste Treatment. Ii. Pilot Plant Demonstration of the Removal of Activity from Low-Level Process Wastes by a Scavenging-Precipitation Ion-Exchange Process. Ornl-3349. ORINS [reports] US Atomic Energy Commission. 1963;86:1-63.
10. Luo X, Zeng XC, He Z et al. Isolation and characterization of a radiation-resistant bacterium from Taklamakan Desert showing potent ability to accumulate Lead (II) and considerable potential for bioremediation of radioactive wastes. Ecotoxicology. 2014;23(10):1915-21.
11. Thiessen KM, Andersson KG, Batandjieva B et al. Modelling the long-term consequences of a hypothetical dispersal of radioactivity in an urban area including remediation alternatives. Journal of environmental radioactivity. 2009;100(6):445-55.
12. Jonsson L, Plamboeck AH, Johansson E, Waldenvik M. Various consequences regarding hypothetical dispersion of airborne radioactivity in a city center. Journal of environmental radioactivity. 2013;116:99-113.



MEDICAL IMAGING

DR PIERRE VASSALLO

PART I IMAGING BREAST IMPLANT RUPTURE

Breast augmentation is the most common form of cosmetic surgery performed today. Most procedures involve the insertion of silicone gel-filled prostheses, which are selected for size and contour based on the woman's body habitus and preference.

The first gel-filled breast implants were developed in the early 1960's, however these suffered from high material failure rates and were initially thought to be linked to connective tissue disorders. Major redesigns and material improvements have lead to the development of 4th and 5th generation implants that have semi-solid silicone filler-gel and a strong silicone capsule. These new implants have the advantage of retaining their original shape and have a lower risk for rupture.

Implant rupture is the most common complication of silicone breast implantation and is more likely to occur with increasing implant age. This is due to weakening of the implant shell; the mean implant life span has been reported to be 13 years.[1]

Due to its semi-solid consistency, rupture of a silicone-filled implant may cause no symptoms and may be incidentally noticed during breast imaging studies. This contrasts with rupture of water-filled implants, which deflate rapidly producing a dramatic change in breast shape. Clinical findings of silicone breast implant rupture, when present, may include changes in breast size or shape, a palpable abnormality in the breast or axilla, pain, or skin tightening.[2]

Mammography does not cause implant rupture; anecdotal cases of this occurrence are likely due to implant leak that occurred prior to the mammographic examination.[3]

A fibrous capsule forms around the implant's shell; this represents the body's attempt to wall itself off from the foreign object; this fibrous capsule creates a barrier that has important implications in limiting flow of free silicone in case of implant rupture. A rupture that involves the implant shell with an intact fibrous capsule is called an intracapsular rupture (Fig 1b), while breakdown of the fibrous capsule with extravasation of silicone into the adjacent tissues is known as an extracapsular rupture (Fig 1c). Around 85% of implant ruptures are of the intracapsular type and most will cause no clinical symptoms or signs. Extension of silicone outside the capsule may induce an inflammatory response that may cause pain and local deformity.

Diagnosis of implant rupture with mammography, ultrasound and Magnetic Resonance Imaging (MRI) has been described in several articles; the advantages of each imaging modality will be discussed below.

MAMMOGRAPHY

Mammography is the least sensitive breast imaging modality for implant rupture. This results from the high density of silicone that prevents internal analysis of the implant. However, evaluation of the contours of a breast implant may indicate a problem with implant integrity (Fig 2a); it is particularly useful to compare with previous exams when analysing changes in implant contour.

Intracapsular tears are mostly missed by mammography. A rounded implant shape may indicate capsular contracture but does not indicated rupture. Calcifications within the capsule occur with older long-standing implants and are not indicative of rupture.

Mammography is useful for detecting an extracapsular rupture since there is extravasation of silicone into the surrounding breast tissue (Fig 3). However, careful attention must be given in the case of a replaced implant, since free silicone will persist within the soft tissues from a previous implant leak. An extracapsular leak may result in silicone collecting within the axillary lymph nodes. However, small amounts of silicone in axillary lymph nodes may result from a process known as "gel-bleed" and are not a sign of implant rupture; gel-bleeds occur when freed silicone molecules that were not fully bound within the polymer capsule leak into surrounding tissues and are transported to regional lymph nodes.

The primary purpose of mammography is to screen for breast cancer; it should not be used to detect implant rupture.

To be continued…

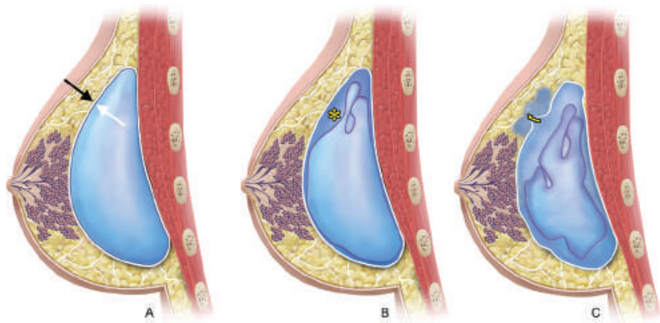


Figure 1: A. Intact implant showing capsule (black arrow) and implant shell (white arrow). **B.** intracapsular rupture with silicone (*) present between the capsule and the shell. **C.** extracapsular rupture with silicone extravasating (arrow) outside the capsule.

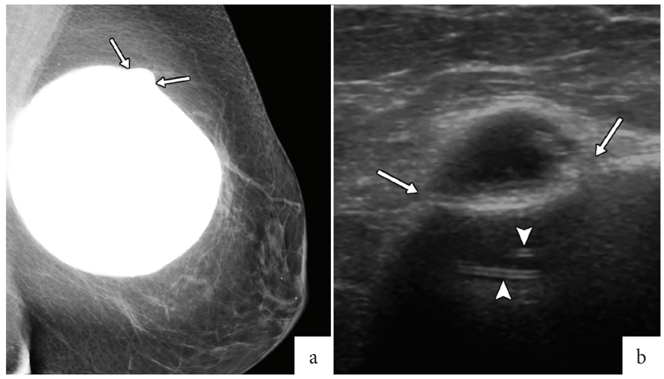


Figure 2: A. Mammogram showing an abnormal implant contour (arrows). **B.** Ultrasound confirms an intracapsular rupture with silicone leak (arrows) and a displaced shell depicted as parallel echogenic lines (arrowheads).

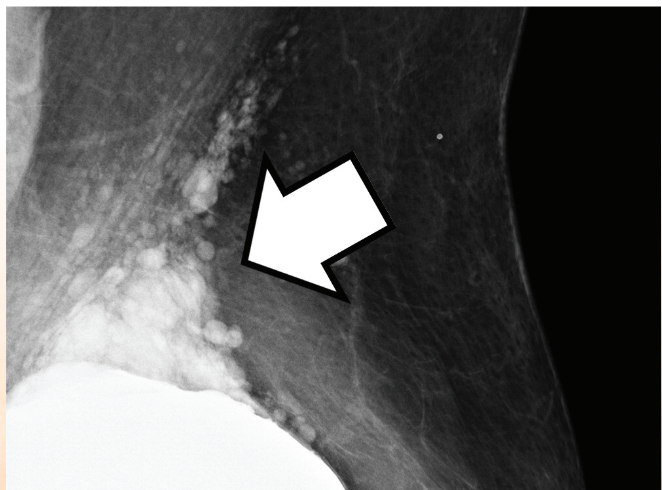


Figure 3: Extravasation of silicone into breast tissue (arrow) confirming an extracapsular implant leak.

REFERENCES

1. Rohrich RJ, Adams WP Jr, Beran SJ, et al. An analysis of silicone gel-filled breast implants: diagnosis and failure rates. Plast Reconstr Surg 1998;102(7):2304–2308; discussion 2309.
2. Hölmich LR, Fryzek JP, Kjøller K, et al. The diagnosis of silicone breast-implant rupture: clinical findings compared with findings at magnetic resonance imaging. Ann Plast Surg 2005;54(6):583–589.
3. Juanpere S, Perez E, Huc O, et al. Imaging of breast implants: a pictorial review. Insights Imaging 2011;2(6):653–670.