Editorial Commentary

“To use or not to use the muscle” that is the question in the capsular contracture dilemma

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Breast surgery is now facing an era of implant based breast reconstructions (IBBRs). In Europe IBBR is the most common choice in case of conservative mastectomy, sometimes comprising more than 90% of the reconstructions performed (1). In US as well, IBBR has been increasingly adopted in the last decades, reaching a rate of approximately 80% of all breast reconstructions (2). There are several reasons for this preference towards a prosthetic based approach, namely invasiveness, time, costs etc. (3). As the numbers rise several technical innovations are revolutionizing this field, with a relentless search of better functional and cosmetic outcomes. Nonetheless, IBBR is not always a pleasure cruise and, apart from early complications, there is a feared, unfortunately common, long-term pitfall: capsular contracture (CC).

CC is defined as an excessive fibrotic reaction to the implanted breast device, creating a thick capsule that causes discomfort, sometimes pain, and also a distortion of the reconstructed breast mound. A commonly used tool of evaluation is the 4-grade Baker scale, where the fourth grade represents a painful, hard and cosmetically awful reconstructed breast.

In literature several studies have reported an incidence of CC ranging from 0.6% to 19% in breast augmentation to 19–48% in breast reconstruction (4). More recent reports show a 10% rate in augmentation (5), while in IBBR the rate of this complication is estimated to be overall 9.8%, with the rate after post-mastectomy radiation therapy (PMRT) being 18.7%, and 7.5% for patients without PMRT (6).

All these rates, by the way, are flawed by the grade of Baker scale that is considered the threshold for CC (the vast majority of Authors consider only grade III and IV, but sometimes the adopted criterion is not reported, making a literature review very difficult), and mostly by the fact that such rating is always dependent on the visiting surgeon and not objectively measurable.

Several factors have been claimed to be the “culprit”: factors such as infection, biofilms, irradiation, hematoma and implant surface type. None of them, by the way, has ever been eventually identified as the “one”. But, some new developments in surgical techniques of IBBR might help us resolve this surgical conundrum.

In fact, a real revolution has changed the IBBR scenario in the last few years, the pre-pectoral approach. This novel technique has been having a sky-rocketing success, really changing the IBBR paradigm.

Among all the advantages of such a technique, there is, without any doubt, a striking long-term outcome of very low CC, trending towards 0% in many series, with an average value of approximately 5% form a recent meta-analysis (7). Two recent studies coherently found that CC is much higher in retro-pectoral cases rather than pre-pec ones (8,9). When considering pre-pec cases only, PMRT makes the difference, as shown in an interesting article on this topic, published on this journal (10), where CC is significantly different in pre-pec cases submitted to PMRT compared to those not submitted to it. Another study, once again published on this journal, showed a rate of CC in pre-pec IBBR cases followed by PMRT of 13.1% (11),

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suggesting that the adopted matrix played the key role. But, regarding this topic, Sinnott (9) found that the contracture rates were three times higher in the retro-pectoral cases submitted to PMRT rather than the pre-pec ones equally submitted to PMRT. This result points out a quite easy hypothesis, that the muscle coverage of the implant is the real difference and not the acellular dermal matrix use, as suggested by the aforementioned study by Graziano (11). At this regard, the aforementioned study of Sobti (8) clearly states: "we found that the difference in CC rates among position of implant groups was statistically significant". So, it seems that the lower rates of CC in pre-pec cases are due to the absence of muscle over the implant rather than to the use of ADMs, also because similar low rates of CC in pre-pec cases have been described using synthetic meshes as well, even in the setting of PMRT (12,13).

Moreover, RT effect in the CC rate of pre-pec cases is maintained even in the setting of pre-mastectomy RT (14). Thus, it seems that there are two main factors involved in the CC process, namely RT and the implant position. But, since CC of pre-pec cases, no matter which mesh is adopted, is mostly induced by RT, either pre- or post-mastectomy, we could possibly argue that this is a particular type of fibrosis and a peculiar type of CC, which could be preferably considered as a separate entity, according to a specific paper on this issue (15). Similarly, in a very recent study from my institution, we found that RT related CC has specific histological features (16).

On the other hand, there are a lot of CCs not related to RT, once again with a striking prevalence in the retro-pectoral cases, as reported by a recent meta-analysis (17), showing that the muscle must be an independent key factor.

Moreover, to clearly highlight the key-role of the muscle, there is most often another drawback accompanying CC, such as "the animation deformity". This phenomenon is never described or seen in a pre-pectoral reconstruction. Hence, a reasonable implication is that being CC dramatically reduced in a pre-pec IBBR, along with animation deformities, the CC we are often facing in IBBR could be due to a mechanical process. This process entails a constant shearing force, between the implant and the muscle, which is obviously higher in a retro-pectoral IBBR, where the force comes from above the implant with a constant crushing effect, rather than in a pre-pec setting. Nonetheless, a shearing force is obviously present in pre-pec IBBRs as well, since the mesh covering the implant, which will become the capsule, is always secured and fixed to the muscle, thus receiving a thrust from behind, anytime the muscle contracts and giving a slight movement to the implant even if it is placed in front of it. This might explain the very low CC rate in pre-pec patients in the absence of PMRT. Anyhow, there must be some other factor, in a multifactorial process, to explain why some patients develop CC while the majority don't.

Another suggestion that might corroborate this hypothesis is related to a novel technical modification, which I personally described on this journal in 2017 (18) and which has been reported by other authors as well afterwards (19-22). This is the denervation of pectoralis major muscle in case of a retro-pectoral approach. Indeed, not all patients are good candidates to a pre-pec IBBR, and a retro-pectoral technique is still a safe and sound option for many patients with specific risk factors. Performing a muscular denervation, during the retro-pectoral pocket dissection, is a quite easy maneuver aimed to avoid the aforementioned animation deformities. As a consequence, a more natural ptosis of the reconstructed breast, which resembles a pre-pec IBBR, is obtained. But, most of all, this technical "trick" can really make the difference in case of a revising surgery done for a long-standing CC (18,22). Capsulectomy and implant changing are not always the solution and might be temporary, while pectoralis major muscle denervation allows an immediate and promising solution with a rewarding feeling for the patient and surgeon together. The rationale of such a procedure relies in avoiding the detrimental effect of the muscular constant movement over the implant. In fact, once the muscle has been detached from its sternal and costal attachments, its functionality becomes definitively compromised, while its viability is still essential to keep a vascularized cushion over the implant. Therefore, a denervation, obtained by means of selective neurotomies, maintains the muscle viable while paralyzing its lower two thirds, the sternal and costal bundles (18). Obviously, an atrophy will follow and will lessen the thickness of the muscle itself to reduce it almost to an autologous biological matrix.

In conclusion, in the tough choice of the "capsular contracture dilemma" there are two important clues: the pre-pec IBBR long-term impressive result in terms of low rates of CC and the pectoralis major muscle denervation as an encouraging approach to prevent and treat long-standing CC and for the avoidance of animation deformities. We could, hence, say that we are almost close to identify the real reason that causes CC, namely a continuous, never-stopping and ominous muscular contracture of the pectoralis major muscle against the breast implant capsule. Therefore, we

could solve the dilemma by saying: not use the muscle when possible or, as an alternative, selectively denervate it when the muscle is necessary!

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