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Breast Augmentation: A Review of Subglandular and Submuscular Implantation

Bernabe Vazquez, M.D., Kenna S. Given, M.D., and G. Courtney Houston, M.D.

Augusta, Georgia

Abstract. A study of 156 patients who underwent augmentation mammoplasty at the Medical College of Georgia from June 1980 to July 1985 is presented. Complete records on 89 patients with 196 implants were obtained. A retrospective analysis with respect to capsular contracture was undertaken. Possible influential variables including age of patient, type of prosthesis, operative blood loss, use of local steroids, and site of insertion (i.e., submuscular versus subglandular) were considered. The site of implant insertion was the only statistically significant factor affecting capsular contracture. The incidence of capsular contracture was 9.4% with the submuscular approach and 58.0% with subglandular contracture. The followup time for the submuscular group was 17.4 months (range of 6–36 months) with the mean time of capsule contracture occurring 4.5 months after insertion. There were no significant differences in intraoperative blood loss or elapsed operating time between the submuscular and the subglandular placements of the prosthesis. This study confirms the submuscular technique of augmentation mammoplasty as the most reliable method of reducing the high incidence of capsular contracture.

Key words: Capsular contraction — Breast augmentation — Submuscular implantation

Capsular contracture continues to be the leading complication of augmentation mammoplasty. Depending on its severity, it can vary from a minor inconvenience to a surgical disaster. It is at best an enigma which has defied solution since the first silicone prosthesis was inserted nearly 25 years ago.

The reported incidence of contracture following subglandular implantation varies from 5 to 74% [12, 16]. A review of our results using this technique on patients between June 1980 and December 1982 revealed a distressingly high 58% contracture formation. Because of this, in January 1983 we began employing the submuscular approach as our preferred choice.

Patients

One-hundred fifty-six patients underwent cosmetic augmentation mammoplasty at the Medical College of Georgia (Augusta) between June 1980 and July 1985. Complete followup was obtained for only 89 of these patients. A total of 196 implants were inserted with approximately equal numbers of subglandular and submuscular placements. There was the usual wide variation in patient age with a mean of 31.9 years.

Methods

All procedures were performed under combination IV sedation and local anesthetic in the outpatient facility. An inferior circumareolar incision was used for both subglandular and submuscular insertions. The submuscular insertions were initially performed using an intact pectoralis major, but, as others have reported, this seemed to shift the implant upward and laterally [13]. Subsequently we began releasing the lower costal and sternal attach-

Address reprint requests to Kenna S. Given, M.D., Division of Plastic Surgery, Medical College of Georgia, Augusta, Georgia 30912-0415, U.S.A.

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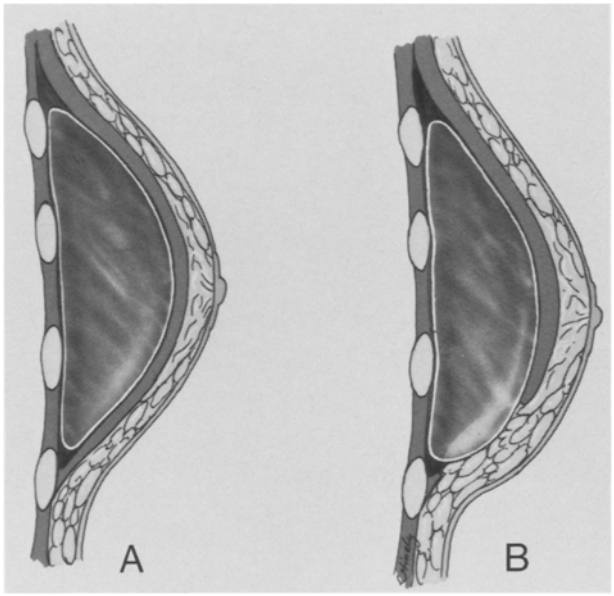

Fig. 1(A) Implant under intact pectoralis muscle. **(B)** Implant under pectoralis muscle with lower costal and sternal attachments released

Table 1. Site of insertion versus contracture

Site	Implants	% Contracture
Subpectoral	96	9.4
Subglandular	100	58.0

Table 2. Surgeon versus contracture

Surgeon	% Implants	% Contracture
K.G.	70.4	29.8
Others	29.6	41.3

ments of the muscle (Fig. 1). A dissection plane between the major and minor pectoralis muscles was sought.

Prior to implant insertion, the surgical pocket was irrigated copiously with Bacitracin antibiotic solution (50,000 u/l) in all patients. The pocket was then suctioned dry and the wound closed in layers. Immediate postoperative expansion exercises as described by Vinick [16] were encouraged. Followup was done by re-examination by two of the authors or by telephone questionnaire. All patients were followed for a minimum of six months and only those contractures classified as Baker Grade III or IV were included [1] in the study.

Table 3. Surgeon versus site of insertion

Surgeon	Site	% Contracture
K.G.	Subglandular	53.2
	Submuscular	9.2
Others	Subglandular	62.5
	Submuscular	10.0

Table 4. Age versus contracture

Age group	Implants	% Contracture
<31 years	110	32.7
>31 years	86	36.1

Besides the site of the insertion the effect of other variables on the incidence of capsular contracture was also considered. The age of the patient, the local use of steroids, the type of prosthesis, and blood loss are all possible factors. The role of each of these was examined in our analysis. Results were evaluated by statistical analysis.

Results

Site of Insertion Versus Contracture

The incidence of capsular contracture varied significantly with the site of insertion. In nearly equal sets of patients we found an incidence of 9.4% with the subpectoral placement versus 58.0% with the subglandular technique ($p < 0.001$) (Table 1).

We were concerned that the surgeon's technique might have influenced the outcome since 70% of these cases were done by the senior author and the remainder by three other surgeons (Table 2). However, the difference between each groups' results was not significant ($p > 0.2$). Furthermore, when we examined each surgeon's cases according to site of implantation, we found similarly low rates for the submuscular group regardless of the surgeon (Table 3).

Age Versus Contracture

Since the mean age of the patients was 31.9 years we used this as an arbitrary cutoff between two age groups to see if age had any effect on capsular contracture. Both groups had essentially equal results (Table 4).

Table 5. Steroid versus contracture

Type of irrigation	Implants	% Contracture
Bacitracin and Kenalog	54	40.7
Bacitracin	142	31.7

Table 6. Manufacturer versus contracture

Manufacturer	Implants	% Contracture
Surgitek	53	35.8
Dow Corning	90	45.5
Heyer-Schulte	47	10.6
Unknown[a]	6	16.7

[a] Manufacturer not listed on operative report

Steroids Versus Contracture

Kenalog in doses of 10–15 mg was instilled in 54 of the surgical pockets after the usual irrigation with the Bacitracin solution. There were no complications from the steroid use although the incidence of contracture was actually higher (Table 5). This difference, however, was not statistically significant ($p > 0.2$).

Prosthesis Versus Contracture

The type of prosthesis used was examined with respect to incidence of contracture. Of the three brands used, the apparent decreased incidence seen with the Heyer-Schulte implants was significant at first glance (Table 6). However, a closer look revealed that 40 of these implants were inserted submuscularly, and when we compared the brand to the site of implantation it was obvious that the significant difference was due to the site (Table 7).

Content of Prosthesis Versus Contracture

Likewise, the content of the implant, whether gel or a combination of gel and saline, had no apparent effect on contracture; we found almost identical results for both groups (Table 8).

Blood Loss Versus Contracture

Finally, we even considered whether the amount of intraoperative blood loss had any prognostic value with respect to capsular contracture but found no significant difference between the three groups (Table 9).

There were no significant differences in intraoperative blood loss or elapsed operating time between the submuscular and subglandular groups (Table 10).

Table 7. Brand of implant versus site of insertion

Manufacturer	Subglandular (% Contracture)	Submuscular (% Contracture)
Surgitek	60.0	8.7
Dow Corning	59.6	14.2
Heyer-Schulte	50.0	8.8

Table 8. Content versus contracture

Content	Implants	% Contracture
Gel	158	34.18
Gel/Saline	38	34.21

Table 9. Blood loss versus contracture

Amount	Implants	% Contracture
50 ml	68	29.4
50–100 ml	106	36.8
100 ml	22	36.4

Table 10. Subpectoral versus subglandular

	Subpectoral	Subglandular
Operative time	143 min	157 min
Blood loss	77 ml	87 ml

Complications

We were fortunate enough not to see any hematomas in any of the 96 submuscular implant patients. Nipple sensation was evaluated in each patient by touch. Hypoesthesia, when it occurred, was usually transient (less than one month) regardless of site. There was only one case of apparent longstanding loss in each group. There was one ruptured implant in each group and no significant problem with infection in either location.

Table 11. Complications (% implants)

	Subglandular	Subpectoral
Hematoma	5.0	—
Nipple hypoesthesia (temporary/permanent)	8.0/1.0	1.04/1.04
Ruptured implant	1.0	1.04
Infection (superficial)	—	1.04
"Active pectoralis"	—	1.04
Implants too small	—	4.16

Table 12. Interval between surgery and contracture (months)

Site	Mean	Range
Subglandular	10.4	1–39
Subpectoral	4.5	1–10

Before we began releasing the lower costal and sternal attachments of the pectoralis muscle, we had one patient who developed a hyperactive pectoralis on one side that eventually required release. Also, when we used the submuscular technique, we had to replace four implants because their postoperative size was smaller than what both patient and surgeon planned for. We have subsequently been using a larger prosthesis than would be necessary in a subglandular position (Table 11).

Followup

This was a five-year study with a mean followup of 38.1 months for the subglandular group and 17.4 months for the subpectoral group. The argument, however, that submuscular insertion simply delays the onset of capsular contracture was not supported in our series. Indeed, when submuscular contractures occurred they generally did so earlier than in the subglandular position. No submuscular contractures occurred later than 10 months after surgery (Table 12).

Discussion

Much has been written regarding the prevention of capsular contracture following augmentation mammoplasty. At the heart of the problem is that we do not understand the etiology of capsular contracture. The two main theories of hypertrophic scarring and infectious etiology are both supported but neither encompasses all the clinical and experimental facts known about this phenomenon [6, 9]. Based on these two schools of thought, many techniques have been proposed to decrease the incidence of contracture. Of these, subpectoral implant insertion, pure saline-inflatable implants, and use of steroids in double lumen prostheses have all been shown to decrease significantly the incidence of capsular contracture [2–4, 8, 10, 12, 14]. Both saline-inflatable prostheses and the use of higher-dose steroids have been associated with predictable complications [11–13]. Subpectoral implant insertion appears to be the only "safe" way to decrease contracture consistently.

Recently, the literature has been full of encouraging reports regarding polyurethane-covered gel-filled implants. There appears to be a decreased incidence of capsular firmness with the use of these implants [5, 7]. There have also been some problems associated with their use (i.e., difficulty at insertion, difficulty at removal, higher incidence of infection) [5, 15]. Whether these problems are real and whether they can be overcome are still subject to debate. This is definitely an exciting area in augmentation mammoplasty and further clinical experience should provide answers to these questions.

This report reviews our experience with augmentation mammoplasty and the resultant incidence of capsular contracture. A retrospective analysis of the variables examined showed the site of implant insertion as the only statistically significant factor. We acknowledge that two other variables, use of antibiotic irrigation and postoperative expansion exercises, have been shown to decrease the incidence of capsular firmness [12, 18, 19]. However, both steps were performed on all our patients so they should not have affected the result.

The overall incidence of capsular contracture in our experience has decreased to 9.4% following the initiation of subpectoral placements.

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