Reduction mammoplasty and back pain: a systematic review and meta-analysis

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Abstract

Purpose There is anecdotal evidence that many patients who undergo reduction mammoplasty (RM) procedures, to relieve symptoms of large breasts, also report improvement in existing back pain. Given how important back pain is as a healthcare burden, the literature which explores the relationship between RM and back pain is sparse. Thus, we aimed to appraise whether such a correlation exists, through systematic review and meta-analysis.

Method Adhering to PRISMA methodology, we used the OVID engine to search the MEDLINE and Embase databases with predefined search terms and inclusion criteria. MeSH terms were not exploded. Statistical analysis was performed using Review Manager 5.3, employing a Mantell–Haenszel method and a fixed-effect model suitable for dichotomous data.

Results The review yielded 13 articles after exclusions, eight of which were suitable for quantitative analysis. The results of the analysis suggested an improvement in back pain following RM across all studies (OR 40.37 [8.09, 201.53] 95% CI, n = 1008). Heterogeneity was high (τ² = 5.14, χ² = 230.37, df = 7 (p < 0.00001) i² = 97%).

Conclusions Although cursory, the evidence gleaned suggests that RM reduces the prevalence of back pain in patients with large breasts. Furthermore, we highlight the scarcity of studies investigating whether RM is at the clinical threshold of efficacy in treating back pain. Although the evidence is insufficient for recommending RM as a management option aimed at treating back pain, this review does identify the need for prospective data looking at back pain metrics as a specific outcome measure before and after reduction mammoplasty.

Graphic abstract

Key points
1. Reduction Mammoplasty
2. Back Pain
3. Systematic Review and Meta-Analysis

Keywords Back · Pain · Reduction · Mammoplasty · Macromastia

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Introduction

Back pain is a leading cause of disability worldwide, with conservative estimates placing its lifetime prevalence in the range of 30–50% across all population groups [1]. Although the majority of cases self-resolve [2], there is a large population of patients who suffer from chronic back pain who are managed by spinal surgeons and pain specialists, with this condition as a large part of their case load. Management of back pain can be difficult with a varying success rate, due in part to the florid aetiology of the condition, and the need for multi-disciplinary input into its treatment. Furthermore, back pain is a large burden to the healthcare economy, accounting for up to one-fifth of healthcare expenditure in some developed systems and costing nearly 2% of developed nations’ GDPs in missed work days [3]. As such, back pain inspires numerous commercial remedies and in lieu of the ageing population will no doubt remain a key target for healthcare interventions in the future.

Macromastia has been reported as a risk factor for the precipitation of back pain [4], and reciprocally those studies that govern the use of reduction mammoplasty (RM) for the management of macromastia often consider improvement in back pain to form part of the symptomatic relief provided by the procedure [5]. However, the literature investigating the direct relationship between RM and back pain is sparse. There are no randomised clinical trials or systematic reviews exploring the correlation between this intervention and back pain as their primary outcomes. Considering the well-documented rise of obesity, which is a precursor to both macromastia [6] and back pain [6], there is rationale to explore the therapeutic value of RM in light of this significant health problem.

RM is a mainstay of treatment in managing symptomatic macromastia. Back pain is often considered to be exacerbated by or secondary to macromastia where the two coexist. It is therefore logical to postulate that RM might improve back pain, although there is sparse evidence in the literature to support this hypothesis.

We hypothesise that RM has a measurable effect on the occurrence of back pain. The extent and mechanism of this relationship are difficult to predict, yet it would most likely be governed by the same causative factors that lead to back pain in macromastia in the first place. Very simply, one can speculate that reducing the mass of tissue carried on the chest might reduce loading of the vertebrae, intervertebral discs, and facet joints, improve sagittal balance, and reduce the incidence or severity of back pain.

Methods

To investigate the relationship between RM and back pain, we performed a systematic literature review and completed a meta-analysis of the results. The latest edition of the PRISMA statement was adhered to, and both checklist and flow diagram are listed [7]. The OVID search engine was used to search the MEDLINE and Embase databases (Fig. 1). The following search terms were entered with the appropriate operators in compliance with the software formatting requirements. MeSH terms were not exploded:

Mammoplasty OR Breast Reduction AND Back OR Pain

These terms were selected so as to appreciate that RM rarely features as a sole intervention and is often colloquially referred in passing in most literature, and hence the broader-term mammoplasty was included to improve the yield of the search.

Once the search was completed, the collected articles were manually screened with the following criteria in mind:

- Articles must have back pain as an outcome and RM as an intervention. They do not need to be the primary research objectives of the article
- Articles must have back pain objectively scored using a data collection tool, and articles with subjective appraisal of back pain by physicians will not be included for analysis.

Some articles that did not fit these criteria, yet offered interesting insights into the mechanisms behind how RM affects the pathophysiology of back pain, were not included for meta-analysis, but have been reported separately in the results section. Furthermore, the articles that fitted the inclusion criteria had their reference lists manually searched, and those references that fit the criteria from those lists were included as additions, this was done only once and subsequent additions did not have their reference lists searched. Data that fit the inclusion criteria were extracted from the articles, and where possible, similar objective pain scoring tools were used to maintain homogeneity across the study outcomes. Following extraction, meta-analysis was performed using Elseviers Review Manager 5.3 software. A Mantell–Haenszel method using a fixed-effect analysis model was selected, as the data were dichotomous.

As part of our survey for sample demographics, we also searched for the length between the subjects having their RM performed, and then being followed up by the researchers/clinicians.
Results

A total of 190 records were identified through the systematic literature review. After screening, nine records remained, in which three were excluded due to barriers of access and language, and five additions were made through manual reference searching, leaving 11 records due for analysis. The most consistent objective outcome tools used to assess back pain were questionnaires sent out either prospectively or results drawn from patient records. Common pain assessment tools such as the visual analogue score and McGill pain questionnaire were sparsely used, with researchers favouring self-designed protocols or locally designed pain assessment tools.

Therefore, the two studies that used the visual analogue score and the sole study that used the McGill questionnaire were excluded from quantitative analysis as they were not numerous enough to qualify for subgroup analysis. The results of those studies are summarised in Table 1. A significant reduction in the score assessing back pain was found in all three records at a confidence interval equal to or greater than 95%.

This left eight articles to be included for quantitative analysis, with respect to the sample demographics across these selected studies, and the vast majority did not report this aspect. The only extractable measure was the date range

| Study     | Year | Sample size | Pain assessment tool used | Mean preoperative score | Mean postoperative score | Improvement |
|-----------|------|-------------|---------------------------|-------------------------|--------------------------|-------------|
| Chao et al. | 2000 | 55          | Visual Analogue Score     | 6.2                     | 0.5                      | 5.7         |
| Goulart et al. | 2013 | 11          | Visual Analogue Score     | 7.0                     | 0.8                      | 6.2         |
| Dale et al.  | 2002 | 184         | McGill Pain Questionnaire | 26.6                    | 11.3                     | 15.3        |
from which the sample population was selected, and in a few studies, the mean number of years between procedure and follow-up was explicitly mentioned. Using the difference between the median year of the sample range and the year of study publication as a surrogate of the mean time taken for study follow-up produced a result of 5.5 years. In those studies, where the length of follow-up was reported, the mean was 3.3 years. These demographics are summarised in Table 2.

In total, data for 1008 patients with back pain who had undergone RM were compiled, with 853 (84.6%) of patients reporting improvement following surgery. An odds ratio of 40.37 (8.09–201.53, \( p < 0.05 \)) favouring improvement in back pain following RM was found. Statistical analysis reveals a very high level of heterogeneity (\(I^2 = 97\%\)); however, as shown in Fig. 2, the overall result remains significant.

There remained five records that were qualitatively analysed, and these records explored the kinematic effects of RM on the alignment of the spine and consequently the posture of patients. They all converged on the conclusion that RM improved patients’ posture, in particular, bringing the alignment of their vertebral angles closer to what is considered normal range. Furthermore, they reported that compressive forces in the lumbar spine were reduced, and functional postural control in patients who underwent RM was significantly improved. The findings of these records are summarised in Table 3.

### Discussion

This meta-analysis supports the study’s hypothesis that RM might improve back pain. At 95% confidence interval, all studies showed some extent of improvement, with some studies suggesting an improvement in odds ratio numbering in the many hundreds. To date, this is the first such study with a correlation between RM and back pain only as its primary outcome. This has some noteworthy implications, as RM does not feature in the guidelines for the management for lower back pain in the developed world. Whilst these data are too crude and retrospective to form the basis of recommending RM as a management option for back pain, they do add to the body of evidence that macromastia and obesity might contribute to back pain and that their management, when present, could form a part of the management plan for back pain sufferers.

### Table 2

| Study               | Study year | Median follow-up (years) | Mean follow-up and range (years) | Sample size |
|---------------------|------------|--------------------------|----------------------------------|-------------|
| Brown et al.        | 2008       | 7                        | n/a                              | 141         |
| Bruhlmann et al.    | 1998       | 17                       | 7.7 (0.9–20.2)                   | 114         |
| Dabbah et al.       | 1995       | 4                        | 3.1 (0.17–5.58)                  | 185         |
| Oren et al.         | 2013       | 0                        | 0                                | 30          |
| Raispis et al.      | 1995       | 4                        | n/a                              | 177         |
| Schnur et al.       | 1996       | 6                        | n/a                              | 195         |
| Miller et al.       | 1995       | 6                        | 5.7 (0.8–8.8)                    | 133         |
| Gonzales et al.     | 1993       | 0                        | 0                                | 33          |
| Average             | N/A        | 5.5                      | 3.3                              | 126         |

### Fig. 2

Quantitative analysis performed showing improvement in back pain following RM (OR 40.37 [8.09, 201.53] 95% CI)
Whilst the National Institute for Health and Clinical Excellence (NICE) guidelines in the UK rightly prohibit the use of BMI as a factor influencing referral for a surgical opinion in patients with chronic back pain [8], it is important that all management options for the management of high BMI are familiar to the specialist managing back pain in order to provide an holistic plan for such patients. This may include RM in much the same way that it may include other weight loss interventions such as dieting or bariatric surgery. As such, given the documented association between high BMI, back pain, and the likelihood of having macromastia [10, 11], these guidelines may require further detail. If RM has therapeutic value for back pain in patients with macromastia, it is reasonable to investigate further whether it holds similar properties in patients with high BMI, who may or may not have macromastia as an added comorbidity. It is worth noting that in addition to weight management and conservative therapy, current surgical interventions for back pain consist of a wide range of stabilisation, joint fusion, and stimulating implant techniques that as a collective are very complex, resource intensive and high risk given the proximity to the spinal cord [9]. Therefore, an intervention such as RM may help to provide symptomatic relief, thereby reducing the number of patients exposed to the risks of spinal surgery.

With respect to why RM may potentially hold some therapeutic value in back pain, the subgroup of records that use kinematic variables as study outcomes point to a potential mechanism. They all highlight how spinal angles relating to thoracic kyphosis, lumbar lordosis, and the correct alignment of the sacrum are deranged in macromastia [10, 11] and improve following RM. One concept that accounts for all these variables is sagittal balance, which is defined as the overall alignment of the spine in the sagittal plane, and has been studied radiographically in healthy volunteers to establish normal parameters [12]. Poor sagittal balance is associated with a surfeit of negative health outcomes [13] and has been explicitly implicated in subjects with low back pain [14]. It follows, that as RM is reported to improve posture by way of optimising sagittal balance, it may in turn reduce the severity of any symptomatic back pain experienced by these patients.

Although our findings argue a case for further exploration of RM as a therapeutic option for back pain, they are incomplete. Nearly all of the records used retrospective methods with which to measure the outcome of back pain, and so in addition to the recall bias, there is also a noticeable deficiency in the extent to which sample demographics were recorded. In our results, the only reproducible statistic was the number of years taken for follow-up. Having access to what relevant comorbidities were present amongst the samples, as well as the distribution in age, height/weight, and kinematic measures would have added to the scope of our results, and our ability to control for any confounding variables.

Moreover, the level of heterogeneity between the records was high and undermines the true statistical significance of the meta-analysis. In addition, each individual study used its own self-report questionnaires and defined macromastia by different parameters such as mass of tissue removed or dimension of breast. To compound this, the studies defined subjects in the binary as having either improved their back pain or not improved following RM. Unlike with the visual analogue or McGill pain score, this gives a statistically coarse measure by which to weight the studies, and allowed for a less powerful analysis.

Limitations such as these are expected, however, given that none of the identified records studied back pain as a primary research outcome. Instead, it would often be indexed as a measure of functionality or improvement in the quality of life of patients following RM, which explains why it was so crudely recorded, and the data so difficult to extract. Regardless, the findings still point to RM having a quantifiable impact on the prevalence of back pain, and they highlight a gap in the literature concerning the correlation between these variables. Any further work should assess the clinical value of RM for back pain in a prospective observational study, where both standardised pain scores and kinematic variables are used, with extent of macromastia recorded to allow researchers to gauge the cut-off at which RM becomes worthwhile. The next stage would be to carry out such a study in a population undergoing RM as a cosmetic procedure or mastectomy as an oncological procedure.
to see whether any change in back pain metrics is observed in these cohorts. Whilst these are not necessarily the cohorts of interest to the particular clinical question being posed, a subset of patients with back pain within these cohorts could be identified and standardised questionnaires used to assess back pain response to the procedure as a primary outcome.

As mentioned before, obesity, macromastia, and poor sagittal balance are becoming rising contributors for back pain. RM can be performed for prices in the range of £4000 [15], which is comparable to other procedures currently used for back pain, with an arguably lower risk profile.

Taking all that has been discussed into account, there is clearly a rationale for the study of RM as part of a multi-facet management strategy for back pain, with future prospective trials strongly indicated. However, the evidence resulting from the current meta-analysis alone is too heterogeneous, and so cannot be solely relied upon as a recommendation for including back pain as an indication for RM, although it clearly demonstrates a possible associative effect between RM and back pain.

Compliance with ethical standards

Conflict of interest None of the authors has any potential conflict of interest.

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