



AMERICAN SOCIETY OF
PLASTIC SURGEONS®

Evidence-based Clinical Practice Guideline: Reduction Mammoplasty

INTRODUCTION

Rationale and Goals

Female symptomatic breast hypertrophy can have negative physical and psychosocial manifestations. As a consequence, female symptomatic breast hypertrophy is now recognized as a medical condition that requires therapeutic management. Given the lack of a lasting non-operative treatment for this condition, female symptomatic breast hypertrophy is most often managed by reduction mammoplasty, which effectively improves the physical and psychological manifestations of the condition. The aim of this document is to address the assessment of symptomatic breast hypertrophy, its treatment through reduction mammoplasty, and to develop a set of recommendations that fairly reflect current accepted medical standards. These guidelines were developed from a comprehensive review of the scientific literature and reflect the consensus of the Health Policy Committee of the American Society of Plastic Surgeons.®

Scope

Treatment of female symptomatic breast hypertrophy takes place within a care continuum that includes: (a) diagnosis and considerations for surgical planning, (b) operative treatment and postoperative care, and (c) follow-up to monitor the surgical result and the patient's overall progress. These guidelines specifically address the diagnostic criteria for female breast hypertrophy, treatment, anticipated outcomes, and follow-up. Graded practice recommendations can be found in Appendix A.

Intended Users

This guideline is intended to be used by plastic surgeons managing the ongoing care of female patients with symptomatic breast hypertrophy. This guideline is also intended to serve as a resource for healthcare practitioners and developers of clinical practice guidelines and recommendations.

Funding Source

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Conflict of Interest

All contributors and preparers of the guideline, including the ASPS Health Policy Committee and staff, disclosed any conflicts of interest via an on-line disclosure reporting database:

Loree Kalliainen, M.D., Chair, has no additional disclosures; Dale C. Vidal, M.D., Past Chair, has a Consultant relationship with Mentor Corporation/Ethicon/J&J; Peter Aldea, M.D., has no additional disclosures; Steven Bonawitz, M.D., has no additional disclosures; Gary Culbertson, M.D., has no additional disclosures; Kevin Chung, M.D., has no additional disclosures; Lynn Damitz, M.D., has no additional disclosures; Leland Deane, M.D., has a consultant relationship with Covidien; Richard Greco, M.D., has a speaker relationship with Mentor Corporation/Ethicon/J&J and a shareholder relationship with Obagi Medical Products; Christopher Hussussian, M.D., has no additional disclosures; Sami Khan, M.D., has no additional disclosures; Bill Kortesis, M.D., has no additional disclosures; Gordon Lee, M.D., has a consultant relationship with Covidien, Inc, LifeCell Corporation/KCI, and TEI, Inc.; Stephen Metzinger, M.D., has no additional disclosures; Galen Perdakis, M.D., has no additional disclosures; Adam Ravin, M.D., has no additional disclosures; Neal Reisman, M.D., has no additional disclosures; Karie Rosolowski, M.P.H., has no additional disclosures; Loren Schechter, M.D., has no additional disclosures; DeLaine Schmitz, R.N, M.S.H.L., has no additional disclosures; Alexander Spiess, M.D., has no additional disclosures; Jennifer Swanson, M.Ed., has no additional disclosures; William Wooden, M.D., has no additional disclosures

METHODOLOGY

Literature Search and Admission of Evidence

A prospective, systematic method was used to identify current literature on the treatment of symptomatic breast hypertrophy. A comprehensive search of PubMed, the Cochrane Database of Systematic Reviews, and the Cumulative Index to Nursing and Allied Health Literature was performed by using various combinations of the following search terms: mammoplasty, reduction mammoplasty, breast reduction, breast hypertrophy, macromastia, as well as a wide range of indexing terms (MeSH terms), free text words and word variants. Search limits restricted results to English-language manuscripts that were indexed as human studies, randomized controlled trials, meta-analyses, clinical trials, or comparative studies. Articles were selected if they were relevant to clinical questions about risk factors, treatment, effectiveness/quality of life, and postoperative complications.

The literature search identified a total of 667 articles. After screening and critical appraisal, the results were narrowed to 22 relevant studies of high to moderate quality. These studies were used to develop practice recommendations. Additional references were included if deemed necessary for discussion; however, these references were neither critically appraised nor used for the development of practice recommendations. Details of literature search terms and search results for each clinical question are provided in Appendix B.

Critical Appraisal of the Literature

The ASPS evidence-based process includes a rigorous critical appraisal process. Each article is appraised by at least 2 reviewers. If a discrepancy exists between the reviewers, the article is appraised by a third reviewer, and the level of evidence is determined by consensus. Articles are appraised with checklists appropriate for the clinical question (therapy, prognosis/risk, or diagnosis) and study design (RCT, cohort/comparative, case-control, etc). ASPS checklists are based on commonly used appraisal tools, e.g., Critical Appraisal Skills Programme (CASP) and the Centre for Evidence Based Medicine (CEBM). Studies were assigned levels of evidence according to the ASPS Evidence Rating Scales for Therapy, Risk, and Diagnosis, which can be found in Appendix C. Evidence ratings were not assigned to studies with inadequately described methods and/or worrisome biases.

Clinical Questions

- In patients with symptomatic breast hypertrophy, do women meeting common insurance coverage criteria for resection volume (compared to women not meeting common insurance coverage criteria) experience increased postoperative relief of breast hypertrophy related symptoms?
- In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, is large resection weight (compared to small resection weight) associated with higher risk of complications?
- In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, is high body mass index, BMI >25, (compared to normal BMI, 18.5-24.9) associated with higher risk of complications?
- In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, does the use of perioperative antibiotic prophylaxis compared to no perioperative antibiotic prophylaxis reduce the risk of infection?
- In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, is a single preoperative dose of antibiotics compared to a perioperative course (24 hr period) effective at reducing the risk of infection?
- In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, does the use of drains (compared to no drains) decrease risk of complications?

Development of Clinical Practice Recommendations

Clinical questions were identified from a list of topics discussed in the 2002 version of this guideline. The ASPS Health Policy Committee sought to update previous practice recommendations with current evidence. Practice recommendations were developed through

critical appraisal of the literature and consensus of the Committee. Recommendations are based on the strength of supporting evidence and were graded according to the ASPS Grades of Recommendation Scale, which can be found in Appendix C.

Peer Reviewer Process

Members of the ASPS Education and Health Quality and Advocacy Committees were invited to peer review this guideline. Peer reviewers were given two weeks to review this guideline using an abbreviated version of the Appraisal of Guidelines Research & Evaluation Instrument developed by the AGREE Collaboration. Forty Committee Members were invited to peer review the guideline and nineteen members responded to the online survey.

Guideline Approval Process

After the peer review process, the guideline draft was re-reviewed and modified by the ASPS Health Policy Committee. The final guideline draft was approved by the ASPS Executive Committee during their May 2011 meeting.

Plan for Updating Guideline

In accordance with the National Guideline Clearinghouse's inclusion criteria, this guideline will be updated within five years to reflect changes in scientific evidence, practice parameters, and treatment options.

BACKGROUND

Symptomatic breast hypertrophy is defined as a syndrome of persistent neck and shoulder pain, painful shoulder grooving from brassiere straps, chronic intertriginous rash of the inframammary fold, and/or frequent episodes of headache, backache, and upper extremity peripheral neuropathies caused by an increase in the volume and weight of breast tissue beyond normal proportions.¹⁻⁴ Although usually seen as symmetric involvement of both breasts, unilateral hypertrophy occasionally occurs. Breast hypertrophy may also become symptomatic after mastectomy of the opposite breast.

Female symptomatic breast hypertrophy can have both physical and psychosocial manifestations. In addition, some patients report impairment in lifting or participating in exercise and other physical activities. Patients may also report low self esteem and dissatisfaction with body image.⁵⁻⁷ Given these consequences, female symptomatic breast hypertrophy is recognized as a medical condition that requires treatment.

There is no lasting non-operative treatment for female symptomatic breast hypertrophy. Orthotic brassieres may offer some relief but often substitute increased discomfort in the shoulders through pressure created by the straps. Operative treatment with reduction mammoplasty currently offers the best approach to symptomatic relief and constitutes the most common therapy for symptomatic breast hypertrophy.⁵

DIAGNOSTIC CRITERIA

A determination of female symptomatic breast hypertrophy is based on individual breast size and symptomatology. The diagnosis of breast hypertrophy involves a comparison of overall body stature with breast size as determined by the relative volume of breast tissue (see definition previously stated).

Symptomatology

The symptoms of female symptomatic breast hypertrophy involve the following:

- Muscle strain, such as backache, neck pain, shoulder pain, and less frequently headache, and/or upper extremity peripheral neuropathy.
- Postural change with a tendency toward dorsal kyphosis.
- Problems associated with breast weight and brassiere support, such as clavicular bra strap grooves.
- Hygiene problems, such as intertrigo or exacerbation of acne and hidradenitis suppurativa.
- Human relations problems, such as embarrassment, sexual harassment, and sexual inadequacy.
- Limitations of normal activity, such as inability to participate in exercise and sports.
- Difficulty sleeping or breathing due to weight of the breasts.
- Problems associated with conspicuous appearance and poor fit of clothing.

The symptoms of female symptomatic breast hypertrophy and their frequency can be quantified using validated, structured questionnaires that encompass both physical and psychosocial symptoms.⁸ Of women presenting for surgical correction of symptomatic breast hypertrophy, 87.6% list at least two out of seven breast-related physical symptoms occurring all or most of the time, as compared with 2% of women with normal breast size (C or smaller).⁹ A small percentage of women presenting for surgery have few or infrequent physical symptoms and request surgery primarily for psychosocial reasons.

Physical Examination

The physical examination should document the diagnosis of symptomatic breast hypertrophy based on the symptomatology. The breast should be free of evidence of breast cancer and any physical abnormality should be appropriately evaluated prior to surgery.

Considerations for Surgical Planning

Breast Volume Removal: Evidence indicates that patients experience similar preoperative breast hypertrophy related symptoms and similar postoperative symptom relief after reduction mammoplasty regardless of resection volume. In a prospective study of 188 patients undergoing reduction mammoplasty for symptomatic breast hypertrophy, it was found that the degree of symptom relief was not correlated with the amount of breast volume removed.¹⁰ When stratifying patients into groups according to the total bilateral amount of breast tissue removed, patients in the 1000 grams or less, 1001-1500 grams, 1501-2000 grams, and greater than 2000 grams groups experienced similar degrees of preoperative symptoms and postoperative symptom relief.¹⁰ Researchers compared the quality of life outcomes among reduction mammoplasty patients

enrolled in the BRAVO study. When comparing surgery outcomes in patients meeting the common criteria for insurance coverage (e.g. (1) at least 500 grams of tissue resected from each breast and (2) meeting 22% cut off criteria on the Schnur sliding scale) to control patients (patients who did not meet insurance criteria), researchers found that there were no differences in preoperative symptoms and postoperative improvement in quality of life across the spectrum of patients.⁹ Thus, this study concludes that the criterion for reduction mammoplasty is more accurately defined by individual symptomatology rather than breast volume alone.

Recommendation: Evidence indicates that resection volume is not correlated to the degree of postoperative symptom relief; thus, the criterion for reduction mammoplasty is more accurately defined by individual symptomatology rather than breast volume alone. **Level II Evidence: Grade B**

Resection weight. Evidence indicates that increased breast resection weight may increase the risk of complications including delayed wound healing, wound dehiscence, nipple/areola necrosis, hematoma, seroma, fat necrosis, hypertrophic scarring, and/or infection with large resection weights.^{3,11-13} Prospective data from the BRAVO study identified a mean resection weight of 793 g for patients without complications versus mean weights of 839, 903, and 1773 g for patients with one, two, and three complications, respectively ($P = .001$).¹¹ According to logistic regression analysis adjusted for age, smoking status, and BMI, every 10-fold increase in resection weight correlated with a 4.8-fold increased risk of complications and an 11.6-fold increased risk of delayed healing.¹¹

Recommendation: Evidence indicates that increased breast resection weight may increase the risk of complication; therefore, patients should be informed of this potential risk. **Level II, III Evidence: Grade B**

Body mass index (BMI). Women of all BMI ranges experience similar benefits from reduction mammoplasty. Research shows inconclusive evidence that the overall postoperative complications of reduction mammoplasty increase as BMI increases.^{3,11,13,14} Women undergoing reduction mammoplasty with high BMI (>25) experience the same complications and at similar rates as women with normal BMI (≤ 25).³

Recommendation: Evidence is inconclusive on whether increased BMI is associated with increased risk of complications; therefore, the decision to perform reduction mammoplasty on a patient with increased BMI is left to the discretion of the surgeon. **Level II, III Evidence: Grade C**

Other Considerations

Cancer risk. Research suggests that breast reduction may decrease the risk of breast cancer, especially in older women (≥ 40 years) and those with larger amounts of breast tissue removed per breast (≥ 600 g), probably due to the removal of mammary glandular tissue.¹⁵⁻²¹ Among women who underwent reduction mammoplasty, reported reductions in breast cancer occurrence ranged from 28% to 50%,^{15-17,19-21} and the discovery of occult breast cancer ranged from 0.05%

to 0.09%.^{16,17,19} These findings are counterbalanced by the potential harms of reduction mammoplasty, including pain, bleeding, infections, scarring, seroma, hematoma, skin or fat necrosis, wound-healing complications, breast asymmetry, change or loss in nipple-areolar sensation, inability to breastfeed, abnormalities on mammography, and the potential to obscure lymphoscintigraphy for breast cancer sentinel node mapping.

When discussing mammogram options with patients, surgeons should be aware of the different breast cancer screening guidelines and base their mammography recommendations on individual patient history and values.

TREATMENT

Non-operative Treatment

Among women presenting for surgical correction of symptomatic breast hypertrophy, conservative, nonsurgical measures have not been shown to be efficacious in providing permanent relief of breast-related symptoms, whereas surgery is both safe and highly successful. One study reports that less than 1% of women found full permanent relief with medications and heat application, and none reported full permanent relief with other nonsurgical treatments.⁵ Over half of those who tried several common treatments, including weight loss, support bras, strengthening exercises, and postural training, reported that these treatments provided no relief. In contrast, both pain and overall health status were markedly improved by breast reduction, essentially restoring functional status to that of age-matched norms.⁵ To date, there are no studies published affirming the cost effectiveness of conservative measures as a first line therapy for the treatment of symptomatic breast hypertrophy.

Operative Procedures

Symptomatic breast hypertrophy is customarily a bilateral condition and consequently usually requires a bilateral procedure. Exceptions to this may include cases of significant breast asymmetry or reduction of the contralateral side when the patient has had a mastectomy and is undergoing reconstruction.

The location of the surgical procedure is at the discretion of the surgeon, assuming an otherwise healthy patient. The surgery can be performed in a hospital operating room, an outpatient surgical facility, or a physician's office. The facility must be accredited and fully equipped to provide adequate monitoring and life-support techniques. Regardless of the location of the surgical facility, the individual performing the surgery should have fully approved hospital privileges for the procedure.

Numerous reduction mammoplasty techniques have been described, including free nipple-areola graft, a variety of nipple-pedicle techniques, and adjunctive liposuction. The common objectives of all the procedures are (1) removal of an adequate volume of breast tissue and skin and (2) reshaping and elevating the remaining breast into a cosmetically pleasing appearance. All techniques leave scars on the breast around the nipple-areola complex, usually in either an "anchor" or vertical design. Technique selection should be individualized to the patient based on the surgeon's training and expertise. The reduction mammoplasty procedure is almost always performed

under general anesthesia, although smaller reduction mammoplasty procedures can be performed under local anesthesia with sedation. Appropriate deep-vein thrombosis prophylaxis is used during and after surgery to prevent thrombophlebitis and pulmonary embolus. Depending on the technique used and the surgeon's average time, a Foley catheter may or may not be used. Arms are padded and secured. Screening of the resected breast tissue, including pathology evaluation, may be recommended when clinically indicated and after careful consideration of patient history, risks, and benefits. After surgery, dressings, brassieres, and/or wraps may be used according to surgeon preference.

Antibiotic prophylaxis. Evidence indicates that perioperative antibiotics may reduce the risk of infection associated with reduction mammoplasty,²²⁻²⁴ as it has been more definitively shown for other breast surgery procedures.^{23,25,26} However, these possible benefits must be weighed against the potential for allergic/anaphylactic reactions, the development of resistant bacteria, and increased costs, which may not be reimbursed by insurance companies. If the decision is made to use prophylactic antibiotics, the physician should bear in mind that bacteria present in the breast ducts may not be covered with commonly used antibiotics.^{22,25}

Recommendation: Evidence indicates that perioperative antibiotics may reduce the risk of infection associated with reduction mammoplasty; thus, surgeons should consider using perioperative antibiotics in reduction mammoplasty patients, taking into account patient risk factors, allergies and issues of antibiotic resistance.

Level II Evidence: Grade C

Drains. Although wound drains can minimize the amount of fluid at the surgical site, evidence indicates that the use of drains neither increases nor decreases postoperative complications, causes greater patient discomfort, and possibly increases the length of the hospital stay.²⁷⁻²⁹

Recommendation: In standard reduction mammoplasty procedures, evidence indicates that the use of drains is not beneficial. However, if liposuction is used as an adjunctive technique, the decision to use drains should be left to the surgeon's discretion.

Level I, II Evidence: Grade A

Postoperative Care

The patient is usually seen in the early postoperative course for wound inspection, and if applicable, drain and/or suture removal. Postoperative care should be determined based on the experience and expertise of the operating surgeon.

OUTCOMES

Effectiveness/Quality of Life

Recent research of female symptomatic breast hypertrophy has focused on both the physical and psychological outcomes of surgery. Studies of this type have consistently shown that reduction mammoplasty is effective at reducing breast-related physical symptoms and improving quality of life.³⁰⁻³² Research documents relief of numerous physical symptoms, including pain in the breast, chest, upper and lower back, neck, arm, and shoulders; headaches;

bra strap shoulder grooving; pain or numbness in the hands; and skin rashes.^{5,30,32} Furthermore, breast reduction surgery can improve functional capacity, including the ability to complete domestic tasks, dress oneself, maintain personal hygiene, walk, and exercise.^{5,30} Improvements in psychological well-being and quality of life have also been well documented, which include increases in extroversion, emotional stability, and self-esteem and decreases in anxiety and depressive symptoms.^{31,33}

Recommendation: Evidence indicates that reduction mammoplasty is effective at reducing breast hypertrophy-related symptoms and improving quality of life. Reduction mammoplasty should be considered for patients with symptomatic breast hypertrophy. **Level I Evidence: Grade A**

Complications

Complications may include the following:

- Infection
- Delayed wound healing
- Wound dehiscence
- Hematoma and/or seroma
- Skin or nipple-areola necrosis
- Fat necrosis
- Cosmetic deformity
- Unfavorable scarring
- Alteration of nipple sensation
- Thromboembolic complications
- Inability to breastfeed
- Need for revision surgery
- Need for physical therapy

FOLLOW-UP

Follow-up appointments are made at the discretion of the surgeon to monitor the healing process, the surgical result, and the patient's overall progress.

CONCLUSIONS

The weight of evidence shows that reduction mammoplasty is an effective treatment for relieving the psychological and physical manifestations, including pain in the neck, back, shoulder, or breast region, of female symptomatic breast hypertrophy. The overall improvement in the health and well-being of these patients directly enhances their ability to perform daily activities in the home, at work, and in the community. As such, reduction mammoplasty should be considered for patients with symptomatic breast hypertrophy in accordance with the recommendations detailed herein.

DISCLAIMER

Evidence-based guidelines are strategies for patient management, developed to assist physicians in clinical decision making. This guideline, based on a thorough evaluation of the scientific literature and relevant clinical experience, describes a range of generally acceptable approaches to diagnosis, management, or prevent specific diseases or conditions. This guideline attempts to define principles of practice that should generally meet the needs of most patients in most circumstances.

However, this guideline should not be construed as a rule, nor should it be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the appropriate results. It is anticipated that it will be necessary to approach some patients' needs in different ways. The ultimate judgment regarding the care of a particular patient must be made by the physician in light of all the circumstances presented by the patient, the diagnostic and treatment options available and available resources.

This guideline is not intended to define or serve as the standard of medical care. Standards of medical care are determined on the basis of all the facts or circumstances involved in an individual case and are subject to change as scientific knowledge and technology advance, and as practice patterns evolve. This guideline reflects the state of knowledge current at the time of publication. Given the inevitable changes in the state of scientific information and technology, periodic review, updating and revision will be done.

CODING

Diagnosis:

Physicians should document the severity of the symptoms of breast hypertrophy (ICD-9: 611.1) and impact on health related quality of life as measured by a breast specific questionnaire which include at least two of the following signs/symptoms:

- Chronic breast pain (ICD-9: 611.71) due to weight of the breasts
- Intertrigo (ICD-9: 695.89) unresponsive to medical management
- Upper back, neck, and shoulder pain (ICD-9: 724.1, 723.1, 723.9)
- Backache, unspecified (ICD-9: 724.5)
- Thoracic kyphosis, acquired (ICD-9: 737.10)
- Shoulder grooving from bra straps (ICD-9: 738.3)
- Upper extremity paresthesia (ICD-9: 782.0) due to brachial plexus compression syndrome secondary to the weight of the breasts being transferred to the shoulder strap area
- Headache (ICD-9: 784.0)
- Congenital breast deformity (ICD-9: 757.6)

Procedure

- 19318 Unilateral reduction mammoplasty
- 19318-50 Opposite breast reduction mammoplasty

Appendix A. Summary of Graded Recommendations, Benefits and Harms

Clinical Questions and Recommendations	Supporting Evidence (References and Level of Evidence)	Grade
<p>RESECTION VOLUME</p> <p><u>Clinical Question</u> In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, do women meeting common insurance coverage criteria for minimum resection volume (compared to women not meeting common insurance coverage criteria) experience increased postoperative relief of breast hypertrophy related symptoms?</p> <p><u>Recommendation</u> Evidence indicates that resection volume is not correlated to the degree of postoperative symptom relief; thus, the criterion for reduction mammoplasty is more accurately defined by individual symptomatology rather than breast volume alone.</p> <ul style="list-style-type: none"> • Benefits: Reduction mammoplasty may provide relief in physical symptoms of breast hypertrophy including reduction in breast pain, chest pain, upper and lower back pain, neck pain, shoulder pain, headaches, brassiere strap shoulder grooving, pain or numbness in hands, and skin rashes; may improve functional capacity including ability to complete domestic tasks, dress oneself, maintain personal hygiene, walk, climb stairs; may improve psychological well-being and quality of life. • Harms: Reduction mammoplasty may result in postoperative complications including seroma, hematoma, hypertrophic scar, delayed scar, nipple necrosis, delayed wound healing, wound dehiscence and contour irregularities leading to secondary surgeries. 	19 (II);28 (II)	B
<p>RESECTION WEIGHT</p> <p><u>Clinical Question</u> In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, is large resection weight (compared to small resection weight) associated with higher risk of complications?</p> <p><u>Recommendation</u> Evidence indicates that increased resection weight may increase risk of complication; therefore, patients should be informed of this potential risk.</p> <ul style="list-style-type: none"> • Benefits: Most patients with large resection weights experience the same relief of breast hypertrophy symptoms compared to patients with lower resection weights. • Harms: Patients with large resection weights may be at increased risk for delayed wound healing, wound dehiscence, nipple loss or necrosis, hematoma, abscess, erythema, areola necrosis, fat necrosis and skin necrosis. 	27 (II); 12 (II/III)16 (II); 17 (II)	B
<p>BMI</p> <p><u>Clinical Question</u> In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, is high body mass index, BMI >25, (compared to normal BMI, 18.5-24.9) associated with higher risk of complications?</p> <p><u>Recommendation</u> Evidence is inconclusive on whether increased BMI is associated with increased risk of complications; therefore, the decision to perform reduction mammoplasty on a patient with increased BMI is left to the discretion of the surgeon.</p> <ul style="list-style-type: none"> • Benefits: Reduction mammoplasty may provide relief in physical symptoms of breast hypertrophy including reduction in breast pain, chest pain, upper and lower back pain, neck pain, shoulder pain, headaches, brassiere strap shoulder grooving, pain or numbness in hands, and skin rashes. • Harms: Research shows inconclusive evidence that complications increase as BMI increases. Women with high BMI experience the same complications as women with normal BMI. 	7 (II); 15 (II/III); 17 (II); 18 (III)	C

Clinical Questions and Recommendations	Supporting Evidence (References and Level of Evidence)	Grade
<p>ANTIBIOTIC PROPHYLAXIS</p> <p><u>Clinical Question</u> In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, does the use of peri-operative antibiotic prophylaxis compared to no perioperative antibiotic prophylaxis reduce the risk of infection?</p> <p>AND</p> <p>In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, is a single preoperative dose of antibiotics compared to a perioperative course (24 hrs) effective at reducing the risk of infection?</p> <p><u>Recommendation</u> Evidence indicates that perioperative antibiotics may reduce the risk of infection associated with reduction mammoplasty; thus, surgeons should consider using perioperative antibiotics in reduction mammoplasty patients, taking into account patient risk factors, allergies and issues of antibiotic resistance. Note: Due to limited evidence findings, a recommendation could not be made on antibiotic prophylaxis timing or duration.</p> <ul style="list-style-type: none"> • Benefits: Antibiotic prophylaxis may prevent surgical infection. • Harms: Antibiotic prophylaxis poses the potential for allergic/ anaphylactic reactions, the development of resistant bacteria, and increased costs, which may not be reimbursed by insurance companies. 	<p>26 (II); 27 (I); 28 (II) 29 (II); 30 (II)</p>	<p>C</p>
<p>DRAINS</p> <p><u>Clinical Question</u> In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty, does the use of drains (compared to no drains) decrease risk of complications?</p> <p><u>Recommendation</u> In standard reduction mammoplasty procedures, evidence indicates that the use of drains is not beneficial. However, if liposuction is used as an adjunctive technique, the decision to use drains should be left to the surgeon's discretion</p> <ul style="list-style-type: none"> • Benefits: Drains may minimize the amount of fluid at operation site. • Harms: Based on current evidence, forgoing drains does not increase the risk of postoperative complications; however, using drains may increase postoperative physical discomfort and breast pain, pinching at drain exit site, painful drain removal, and drain exit scar. 	<p>31 (II); 32 (I/II); 33 (II)</p>	<p>A</p>
<p>QUALITY OF LIFE</p> <p><u>Clinical Question</u> In patients with symptomatic breast hypertrophy, does reduction mammoplasty (compared to no treatment) reduce symptoms and improve quality of life?</p> <p><u>Recommendation</u> Evidence indicates that reduction mammoplasty is effective at reducing breast-related symptoms and improving quality of life; therefore, reduction mammoplasty should be considered for patients with symptomatic breast hypertrophy.</p> <ul style="list-style-type: none"> • Benefits: Reduction mammoplasty may provide relief in physical symptoms of breast hypertrophy including reduction in breast pain, chest pain, upper and lower back pain, neck pain, shoulder pain, headaches, brassiere strap shoulder grooving, pain or numbness in hands, and skin rashes; may improve functional capacity including ability to complete domestic tasks, dress oneself, maintain personal hygiene, walk, climb stairs; may improve psychological well-being and quality of life. • Harms: Reduction mammoplasty may result in postoperative complications including seroma, hematoma, hypertrophic scar, delayed scar, nipple necrosis, delayed wound healing, wound dehiscence and contour irregularities leading to secondary surgeries. 	<p>3 (I); 4 (I); 6 (I); 34 (III)</p>	<p>A</p>

Appendix B. Clinical Questions and Literature Search Strategies

CLINICAL QUESTION:

Population: In patients with symptomatic breast hypertrophy

Exposure (Risk Factor): do women meeting common coverage criteria for resection volume

Comparison: compared to women not meeting common coverage criteria

Outcome: experience increased postoperative relief of breast hypertrophy related symptoms?

SEARCH TERMS:

Medline: (“Mammoplasty”[Mesh] AND “Reduction”) OR “Mastopexy” OR “Breast Reduction” OR “Breast Hypertrophy” OR “Macromastia”) AND (“Resected tissue volume” OR “Resection weight” OR “Volume of resection” OR “Tissue Volume” OR “Volume” OR “Schnur Scale” OR “Insurance Coverage” OR “Outcomes”); (“Reduction Mammoplasty” OR “Breast Reduction” OR “Breast Hypertrophy” OR “Macromastia” OR “Mastopexy”) AND (“Resected tissue weight” OR “Volume”); (“Mammoplasty”[Mesh] AND “Reduction”) OR “Breast Reduction”) AND “Volume” OR “Resection weight” AND “Symptom Relief” Limits: English

CINAHL: (“Reduction Mammoplasty” OR “Breast Reduction” OR “Breast Hypertrophy” OR “Macromastia”) AND (“Volume” OR “Resected Tissue Weight” OR “Resection Weight”)

Cochrane: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

INCLUSION CRITERIA:

- Relevance to clinical question
- At least 10 patients
- Prospective or retrospective
- Not a case series or case report

Primary Search

Databases:

- Medline (227)
- CINAHL (3)
- Cochrane (0)

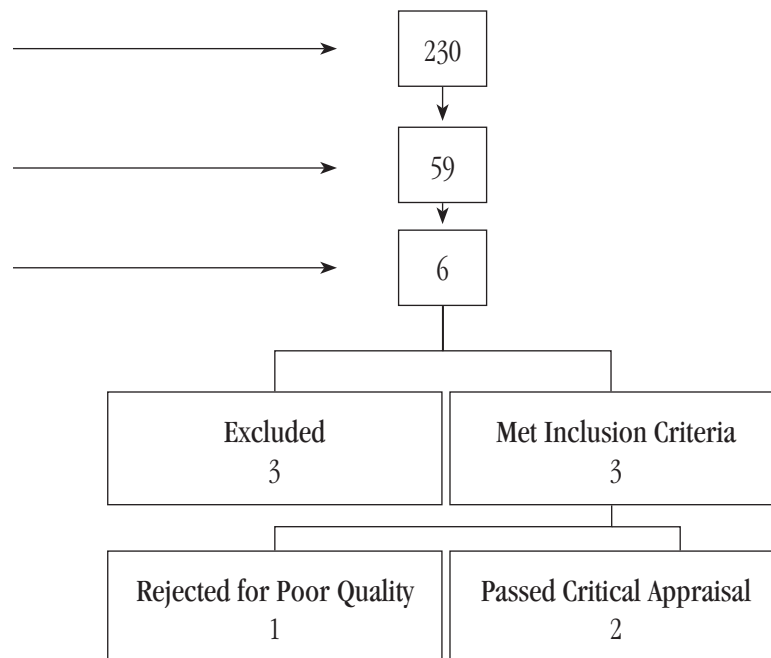
Title Search

Relevant titles from above total

Abstract Search

Relevant abstracts from title search

Citations Identified



CLINICAL QUESTION:

Population: In patients with breast hypertrophy undergoing reduction mammoplasty

Exposure (Risk Factor): is large resection weight

Comparison: compared to small resection weight

Outcome: associated with higher risk of complications?

SEARCH TERMS:

Medline: (“Mammoplasty/adverse effects”[Mesh]) AND (“resection weight” OR “resected tissue weight” OR “breast weight” OR “breast tissue weight” OR “specimen weight” OR “excised tissue weight” OR “resection volume” OR “resected tissue volume”) Limits: English

CINAHL: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

Cochrane: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

INCLUSION CRITERIA:

- Relevance to clinical question
- At least 10 patients
- Prospective or retrospective
- Not a case series or case report

Primary Search

Databases:

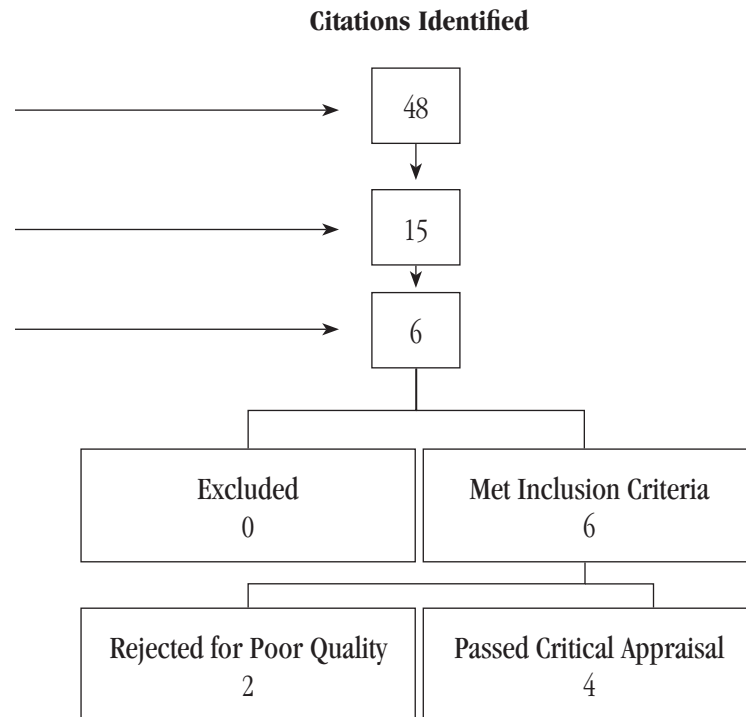
- Medline (33)
- CINAHL (15)
- Cochrane (0)

Title Search

Relevant titles from above total

Abstract Search

Relevant abstracts from title search



CLINICAL QUESTION:

Population: In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty

Exposure (Risk Factor): is high BMI

Comparison: compared to normal BMI

Outcome: associated with higher risk of complications?

SEARCH TERMS:

Medline: ((“Mammoplasty”[Mesh] AND “reduction” NOT “augmentation”)) AND (“Body Mass Index”[Mesh] OR “obesity”[Mesh]) Limits: English

CINAHL: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (general search of all articles, as specific search terms resulted in 0 articles)

Cochrane: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (general search of all articles, as specific search terms resulted in 0 articles)

INCLUSION CRITERIA:

- Relevance to clinical question
- At least 10 patients
- Prospective or retrospective
- Not a case series or case report

Primary Search

Databases:

- Medline (47)
- CINAHL (15)
- Cochrane (0)

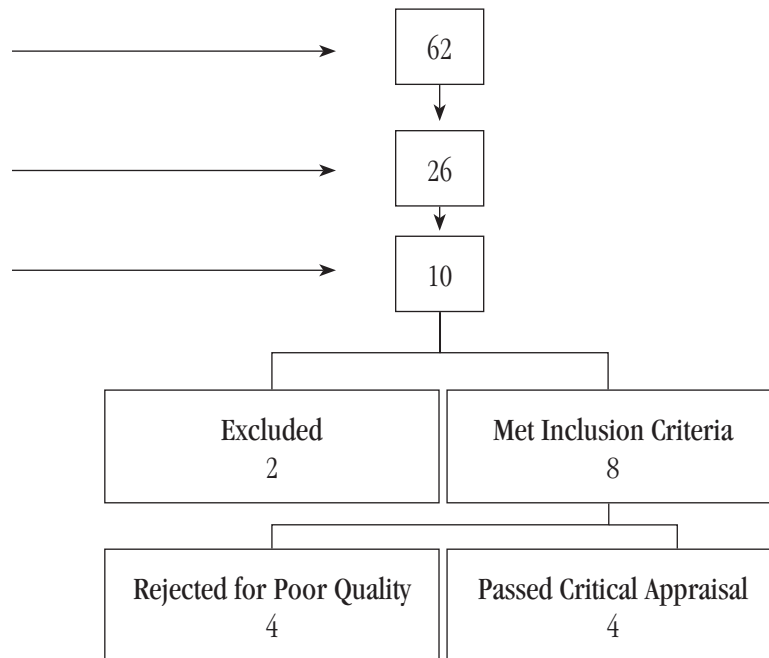
Title Search

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CLINICAL QUESTION:

Population: In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty

Intervention: does the use of perioperative antibiotic prophylaxis

Comparison: compared to no perioperative antibiotic prophylaxis

Outcome: reduce the risk of infection?

AND

Population: In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty

Intervention: is a single preoperative dose of antibiotics

Comparison: compared to a perioperative course (24 hrs)

Outcome: effective at reducing the risk of infection?

SEARCH TERMS:

Medline: (“Mammoplasty”[Mesh] AND “Reduction”) OR “Breast Reduction” OR “Breast Surgery” OR “breast hypertrophy” OR “Macromastia”) AND (“Risk”[Mesh] AND “Infection”[Mesh] OR “Surgical Wound Infection”[Mesh] OR “Wound Infection”[Mesh]); (“Mammoplasty”[Mesh] AND “Reduction”) OR “Breast Reduction” OR “Breast Surgery” OR “breast hypertrophy” OR “Macromastia”) AND (“Premedication”[Mesh] OR “Antibiotic Prophylaxis”[Mesh] OR “Antibiotic Prophylaxis/utilization”[Mesh]) AND (“Risk”[Mesh] AND “Infection”[Mesh] OR “Surgical Wound Infection”[Mesh] OR “Wound Infection”[Mesh]); (“Mammoplasty”[Mesh] AND “Reduction”) OR “Breast Reduction” OR “Breast Surgery” OR “breast hypertrophy” OR “Macromastia”) AND (“Premedication”[Mesh] OR “Antibiotic Prophylaxis”[Mesh] OR “Antibiotic Prophylaxis/utilization”[Mesh]); (“Mammoplasty”[Mesh] AND “Reduction”) OR “Breast Reduction” OR “Breast Surgery” OR “breast hypertrophy” OR “Macromastia”) AND (“Premedication”[Mesh] OR “Antibiotic Prophylaxis”[Mesh]) AND “dosage”; (“Mammoplasty”[Mesh] AND “Reduction”) OR “Breast Reduction” OR “Breast Surgery” OR “breast hypertrophy” OR “Macromastia”) AND (“Premedication”[Mesh] OR “Antibiotic Prophylaxis”[Mesh] OR “Antibiotic Prophylaxis/utilization”[Mesh]) **LIMITS:**

Humans, English, Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Comparative Study, Journal Article

CINAHL: “Breast Reduction” OR “Reduction Mammoplasty” AND “Antibiotic Prophylaxis” LIMITS: Research article

Cochrane: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

INCLUSION CRITERIA:

- Relevance to topic
- At least 10 patients
- RCT or Systematic Review/Meta-Analysis of RCTs

Primary Search

Databases:

- Medline (80)
- CINAHL (10)
- Cochrane (0)

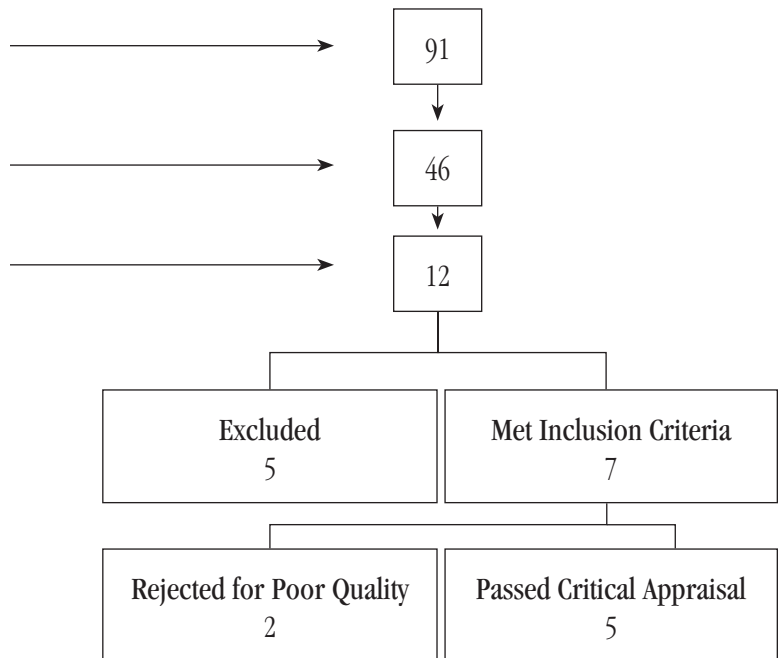
Title Search

Relevant titles from above total

Abstract Search

Relevant abstracts from title search

Citations Identified



CLINICAL QUESTION:

Population: In patients with symptomatic breast hypertrophy undergoing reduction mammoplasty

Intervention: does the use of drains

Comparison: compared to no drains

Outcome: decrease risk of complications?

SEARCH TERMS:

Medline: (“Mammoplasty”[Mesh] AND “reduction” NOT “augmentation”) AND “drains”; (“Mammoplasty”[Mesh] AND “reduction”) AND “drains”; “breast reduction” AND “drains”; “breast reduction” AND “drainage”; (“Mammoplasty”[Mesh] AND “reduction”) AND “drainage”; (“Mammoplasty”[Mesh] AND “reduction” NOT “augmentation”) AND “drainage” Limits: English

CINAHL: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

Cochrane: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

INCLUSION CRITERIA:

- Relevance to clinical question
- At least 10 patients
- Meta-analysis, Systematic Review or RCT

Primary Search

Databases:

- Medline (35)
- CINAHL (15)
- Cochrane (0)

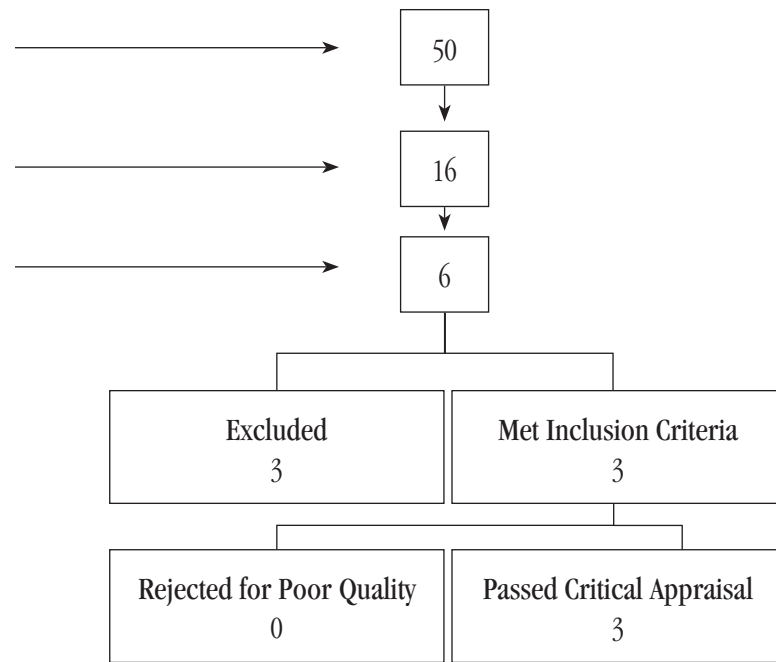
Title Search

Relevant titles from above total

Abstract Search

Relevant abstracts from title search

Citations Identified



CLINICAL QUESTION:

Population: In patients with symptomatic breast hypertrophy Intervention: does reduction mammoplasty

Comparison: compared to no treatment

Outcome: reduce symptoms and improve quality of life?

SEARCH TERMS:

Medline: “Pathological Conditions, Signs and Symptoms”[Mesh] AND (“macromastia” OR “breast hypertrophy”) AND “treatment”; (“Mammoplasty”[Mesh] AND “reduction”) AND (“Pathological Conditions, Signs and Symptoms”[Mesh] AND “relief of”); “breast hypertrophy” AND “Quality of Life”[Mesh]; “Mammoplasty/psychology”[Mesh] AND “reduction”; “Mammoplasty/methods”[Mesh] AND “reduction” AND “Quality of Life”[Mesh] All with Limits: English

CINAHL: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

Cochrane: “Reduction Mammoplasty”; “breast reduction”; “breast hypertrophy”; “macromastia” (conducted general search of all articles because initial search with specific terms resulted in 0 articles)

INCLUSION CRITERIA:

- Relevance to clinical question
- At least 10 patients
- Meta-analysis, Systematic Review or RCT

Primary Search

Databases:

- Medline (173)
- CINAHL (13)
- Cochrane (0)

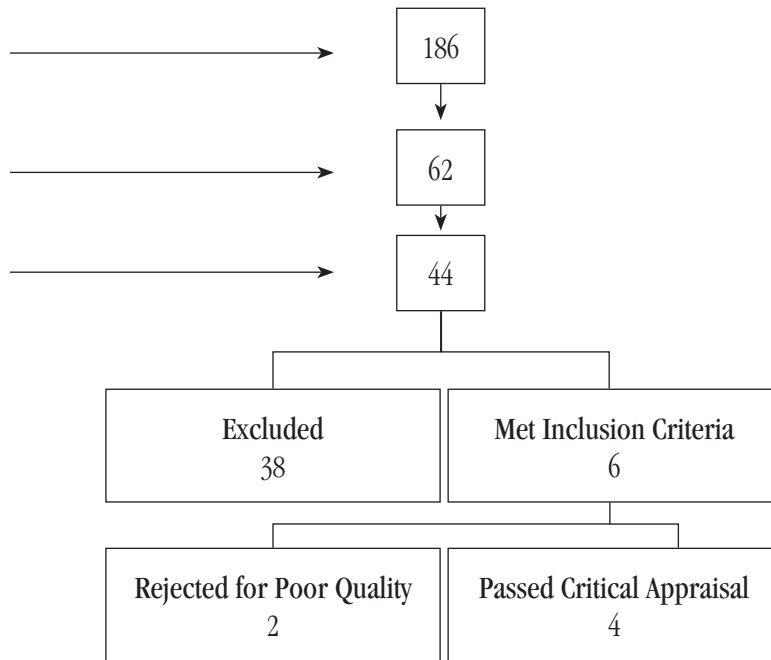
Title Search

Relevant titles from above total

Abstract Search

Relevant abstracts from title search

Citations Identified



Appendix C. ASPS Evidence Rating and Grades of Recommendation Scales

Evidence Rating Scale for Therapeutic Studies

Level of Evidence	Qualifying Studies
I	High-quality, multi-centered or single-centered, randomized controlled trial with adequate power; or systematic review of these studies
II	Lesser-quality, randomized controlled trial; prospective cohort or comparative study; or systematic review of these studies
III	Retrospective cohort or comparative study; case-control study; or systematic review of these studies
IV	Case series with pre/post test; or only post test
V	Expert opinion developed via consensus process; case report or clinical example; or evidence based on physiology, bench research or “first principles”

Evidence Rating Scale for Diagnostic Studies

Level of Evidence	Qualifying Studies
I	High-quality, multi-centered or single-centered, cohort study validating a diagnostic test (with “gold” standard as reference) in a series of consecutive patients; or a systematic review of these studies
II	Exploratory cohort study developing diagnostic criteria (with “gold” standard as reference) in a series of consecutive patient; or a systematic review of these studies
III	Diagnostic study in nonconsecutive patients (without consistently applied “gold” standard as reference); or a systematic review of these studies
IV	Case-control study; or any of the above diagnostic studies in the absence of a universally accepted “gold” standard
V	Expert opinion developed via consensus process; case report or clinical example; or evidence based on physiology, bench research or “first principles”

Evidence Rating Scale for Prognostic/Risk Studies

Level of Evidence	Qualifying Studies
I	High-quality, multi-centered or single-centered, prospective cohort or comparative study with adequate power; or a systematic review of these studies
II	Lesser-quality prospective cohort or comparative study; retrospective cohort or comparative study; untreated controls from a randomized controlled trial; or a systematic review of these studies
III	Case-control study; or systematic review of these studies
IV	Case series with pre/post test; or only post test
V	Expert opinion developed via consensus process; case report or clinical example; or evidence based on physiology, bench research or “first principles”

Scale for Grading Recommendations

Grade	Description	Qualifying Evidence	Implications for Practice
A	Strong Recommendation	Level I evidence or consistent findings from multiple studies of levels II, III, or IV	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
B	Recommendation	Levels II, III, or IV evidence and findings are generally consistent	Generally, clinicians should follow a recommendation but should remain alert to new information and sensitive to patient preferences.
C	Option	Levels II, III, or IV evidence, but findings are inconsistent	Clinicians should be flexible in their decision-making regarding appropriate practice, although they may set bounds on alternatives; patient preference should have a substantial influencing role.
D	Option	Level V: Little or no systematic empirical evidence	Clinicians should consider all options in their decision-making and be alert to new published evidence that clarifies the balance of benefit versus harm; patient preference should have a substantial influencing role.

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