



Gender Affirming Surgeries of the Trunk

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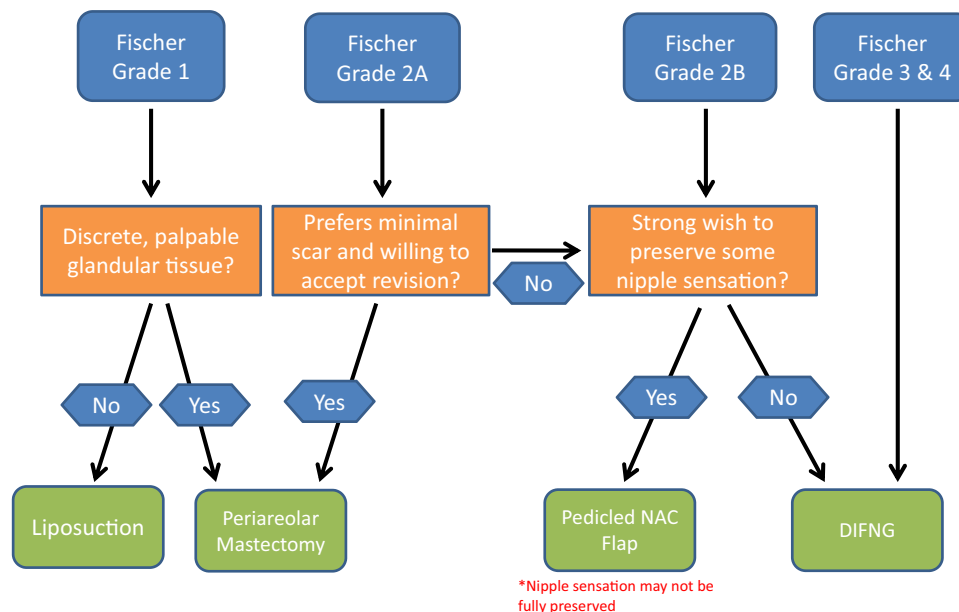
Abstract

Purpose of Review This review aims to explore the current concept, techniques, outcomes and safety of gender affirming surgeries of the trunk for transgender and gender non-conforming individuals.

Recent Findings Gender affirming surgery is increasingly becoming more accessible to patients with gender dysphoria. Chest surgery is the most popular form with various surgical techniques that one can utilize. It is critical for operating surgeons to understand the nuances of these procedures when compared to cis-gender body contouring procedures. Recent outcome data show that these procedures are safe and well tolerated with high patient satisfaction and mental health benefits. Further long-term outcome data are needed.

Summary Gender affirming surgery of the trunk is a safe and well-tolerated treatment for patients with gender dysphoria with high patient satisfaction and mental health benefits.

Graphical Abstract



Keywords Gender affirming surgery · Top surgery · Chest masculinizing surgery · Breast augmentation · Transgender health

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Introduction

While gender diversity has existed to various degrees throughout the history among different cultures, it was not until the 1930s that Transgender and gender non-conforming (TGNC) individuals were offered options for medical and surgical transition [1]. First commercial estrogen was developed in 1933 [2], followed by the first synthesis of testosterone in 1935 [3]. Around the same time, the first recorded gender affirming surgery (GAS), vaginoplasty, was performed at the Institute of Sexual Science in 1931 by Dorchen Richter [4]. Since the early 1900s, the field of medicine and surgery has developed significantly to allow a more comprehensive, sophisticated, and individualized care for TGNC patients. Numerous studies have shown psychological benefits of gender affirming surgeries [5, 6]. Gender affirming surgery has become more accessible in recent years, with chest and breast surgery comprising more than half of all gender affirming surgeries performed in US [7]. This review aims to provide an overview of current concepts, techniques, and outcomes of gender affirming surgeries of the trunk.

Chest Masculinizing Surgery

Chest masculinizing surgery, often colloquially termed as “top surgery,” focuses on significant removal of breast tissue and nipple reconstruction to allow flatter, more masculine appearing chest. Nipple-areolar complex (NAC) is often re-shaped and re-positioned as part of the procedure. Prior to surgery, patient selection must be done carefully. World Professional Association of Transgender Health Standards of Care (WPATH) laid out a clear guideline when selecting appropriate candidates for this surgery: 1. Persistent and well-documented gender dysphoria; 2. Capacity to make a fully informed decision and consent; 3. Age of majority in a given country; 4. Well-controlled mental and medical health concerns, if present. While hormone therapy is recommended prior to surgery, it is not a strict requirement [8]. As the idea of “gender” developed over time, we now understand that gender is less of a binary system and more of a spectrum. There are people who identify themselves outside of the traditional binary system (non-binary, genderqueer, genderfluid) and may wish to pursue chest masculinizing surgery but not wish to be on testosterone. Given such patient diversity, it is paramount to note that successful gender affirming care requires a multi-disciplinary approach comprised medical, surgical, and mental health providers.

When planning for chest masculinizing surgery, one must consider both the patient’s native anatomy as well as

their preference for best outcome. Breast volume, degree of ptosis, and skin elasticity, which is often affected by binding history and body habitus, should be examined thoroughly during the preoperative visit. There are multiple algorithms that help decide preferred surgical technique based on these previously mentioned patient factors [9–12]. Our algorithm is shown on Fig. 1, which not only incorporates physical exam findings but also patient preferences. The three primary surgical techniques include periareolar technique and its variations, double-incision with free nipple grafting (DIFNG), and pedicled NAC flap. While liposuction can be a useful adjunct, there is typically a significant glandular component that is not amenable to liposuction alone and requires some method of open resection. Each technique has unique advantages and disadvantages that will be discussed below.

Periareolar/Circumareolar Technique

Periareolar technique involves breast tissue removal and NAC reconstruction utilizing minimal amount of incision. This technique is most suitable for patients with small-sized breast and minimal ptosis for several reasons. First, breast tissue excision is done through a small, limited incision which makes this a much more technically challenging for patients with larger breast. Such limited visibility and technical challenge is thought to be the cause of higher rates of complication post-op, including hematoma. Literature reports wide range of hematoma with periareolar technique ranging from 0 to 33% [13–15].

While the skin envelope will contract moderately post-op, a large amount of preexisting skin redundancy will result in suboptimal chest contour since this technique does not allow for significant amount of skin removal. In order to address skin redundancy and achieve conservative NAC movement, a circumareolar design may be utilized where a circumferential doughnut of skin is deepithelialized. An inferior peri-areolar access incision is utilized through the deepithelialized segment and the NAC is pedicled on the superior dermoglandular component. This has the additional advantage of a larger inferior access incision which improves visualization during glandular resection. However, the amount of NAC movement is limited and will result in poor aesthetic result for patients with significant amount of breast ptosis. This was made evident by a previous study showing patients with Fischer grade 2B (moderate glandular tissue, increased skin laxity, NAC below IMF) who underwent periareolar top surgery had significantly higher rates of revision compared to the patients who underwent DIFNG top surgery (48.6% vs 20%, $p=0.049$) [14]. Similarly, previous studies showed higher rates of revision for periareolar technique and its variants, ranging from 10 to 60% with the extended concentric circular technique showing the highest rate of revision [9,

Fig. 1 12 months post-op photo of a patient who underwent periareolar/circumareolar chest masculinizing surgery



16]. Hence, periareolar/circumareolar techniques should be offered judiciously to patients with smaller glandular volumes and minimal amount of breast ptosis for the optimal surgical outcome.

Technical Steps for Periareolar Mastectomy

- A. Surgical sites are marked in pre-op area. Midline, breast footprint, and IMF are marked. If a circumareolar approach is utilized, symmetry of the planned skin resection, typically a horizontal ellipse, is confirmed from sternal notch, midline, and IMF.
- B. Tumescent solution is infiltrated circumferentially to hydrodissect the plane of the breast capsule.
- C. While the tumescent is setting, the size and shape of the nipple is evaluated. Male NAC is oval and typically positioned about 1cm above the inferior pectoralis border and 2–2.5 cm medial to the lateral border of the pectoralis. Another helpful landmark is deltopectoral groove; male nipple typically is in line with deltopectoral groove. For patients with appropriate NAC size and position; the periareolar semicircular incision coursing the lower half of NAC can be utilized. Many patients will require a circumareolar approach with a certain degree of NAC reduction. The NAC is marked with a 22 mm circular cutting guide. The corresponding elliptical incision drawn preoperatively is confirmed and the interval skin de-epithelized. The superior half provides the NAC pedicle and the inferior aspect opened to allow direct tissue resection.
- D. Using the access incision, facelift scissor dissection is utilized to elevate the mastectomy flaps off of the breast capsule until the entire mastectomy flap is elevated and the borders of the gland defined down to pectoralis major fascia. At least 1cm thick adipose tissue is left under the NAC to avoid a saucer deformity.
- E. Using a lighted retractor, the medial edge of the gland is grasped with Allis clamps and cautery used to elevate the gland off of pectoralis major fascia from medial to lateral until the completely excised.
- F. PECS2 regional block is performed with Ropivacaine and dexamethasone under direct vision. We utilize surgeon-delivered technique as described by Thomas et al. [17].

- G. 15 Fr Blake drains are placed and the incisions closed in layers
- H. A compressive vest is placed and worn for 4 weeks post-operatively (Fig. 1).

Double Incision with Free Nipple Grafting (DIFNG)

This technique is the most commonly utilized technique in chest masculinizing surgery as it is reproducible and reliable even for patients with larger native breast tissues and significant degree of ptosis. It facilitates complete removal of the glandular tissue and obliteration of the inframammary fold, control of excess skin envelope, and reshaping and repositioning of the NAC. Studies comparing varying techniques have demonstrated that DIFNG has significantly lower complication and revision rates compared to that of periareolar and/or its variants as well as the pedicled NAC techniques [18]. However, this technique does leave the heaviest scar burden which can be obvious especially in the setting of hypertrophic scarring or keloid formation. While this technique enables direct control of the relevant anatomy, detailed attention should be paid to NAC graft position, mastectomy flap thickness, complete obliteration of inframammary fold, and incision placement for the best aesthetic results.

There have been various methods describing NAC positioning using anatomic landmarks. This can be done by using the sternal midline, ribs, and lateral pec border; previous authors have noted that male NAC should be positioned over either the 4th intercostal space or the 5th rib, about 11 cm from the sternal midline which corresponds to 2.5 cm medial to the lateral pec border [19, 20]. The vertical axis from the deltopectoral groove is another anatomic marker that can be used to confirm the placement of the nipple [21]. Some advocate for placement over the 4th rib and choosing the vertical coordinate by dividing each chest into thirds and placing the nipple over the 2/3 mark [22].

Mastectomy flap dissection follows the areolar plane of the breast capsule to ensure uniform contour and ideally matches the thickness of the infraclavicular and epigastric subcutaneous tissue. Thin mastectomy flaps may result in a concave or “hollowed out” look of the chest with an unnatural transition from the mastectomy skin to the surrounding subcutaneous adipose thickness. Prominent residual IMF attachments can lead to both contour deformity as well as a more feminine-appearing chest; hence, complete disinsertion and excision of the IMF should be performed while preserving the overlying subcutaneous fat. Lastly, there have been a few studies reporting outcomes regarding drain-free chest masculinizing with potentially reduced risk of hematoma and re-operation but with higher risk of seroma [23, 24]. In our experience, we always place drains for any chest masculinizing surgery given the wide area of dissection and minimal morbidity.

Technical Steps for Double Incision Mastectomy with Free Nipple Graft

- A. Surgical sites are marked in pre-op area. Midline, breast footprint, lateral border of pectoralis major, and IMF are marked. Upper incision is drawn at the anticipated level of the pectoralis major muscle insertion often just above the transposed IMF (Pitanguy point) or at the superior border of the higher NAC for a patient with small breast with minimal ptosis.
- B. 22 mm circular cutting guide is used to harvest the free nipple graft which gets thinned on the back table
- C. The upper incision is made and superior breast flap elevated at the level of the breast capsule until pectoralis major fascia is identified and the upper pole of the gland defined.
- D. The glandular tissue is elevated off of pectoralis major fascia from superior to inferior and continues a few centimeters below the IMF to allow complete disinsertion.
- E. The upper skin flaps are remarked at the anticipated lateral pectoralis major border. This point is held in position under minimal tension with a penetrating towel clamp and the inferior skin flap transposed superiorly to mark the lower incision level. This mark is extended medially and laterally with a gentle curve to connect with the upper incision.
- F. The resection is performed by completing the inferior border incision, ensuring that the IMF is completely excised.
- G. PECS2 block is performed with a mixture of Ropivacaine and dexamethasone under direct visualization [17].
- H. Skin is tailor tacked closed with staples and NAC positions are preliminarily marked 2 cm medial to the lateral pectoral border and 1 cm above the incision with symmetry confirmed from midline (typically 10.5–12 cm). The patient is then sat upright for symmetry and position confirmation, and a plumb line from the deltopectoral groove used as a secondary landmark.
- I. Incision closure is performed with two layers of subcuticular barbed suture over 15F drains.
- J. Nipple graft recipient bed is marked using a 20×26 mm oval cutting guide that is then de-epithelialized and the thinned NAC graft sutured in place. For patients with BMI > 35, the 22 mm circular cutting guide is used and then widened by 2 mm medially and laterally, which allows for a more natural NAC shape based on their body habitus. Nipple bolsters are secured with Tegederm dressing.
- K. A compressive vest is worn for 4 weeks and bolster removal occurs on postoperative day 5 (Fig. 2).

Fig. 2 12 months post-op photos of a patient who underwent DIFNG chest masculinizing surgery



Pedicled NAC Flap Technique

Also referred to as the “button hole top surgery”, this technique allows for preservation of NAC on a thin dermoglandular flap that is most often inferiorly based. The incision design is similar to the double incision approach, but the broadly based inferior skin flap is de-epithelialized and tucked underneath the mastectomy flap. The pedicled NAC are then brought out through full thickness skin defects after being sited in a similar manner to the NAC graft position in a double incision. Previous study has shown that majority of the patients rated their nipple sensation as ranging from very good to good post-operatively [11]. Some authors advocate for thicker flap measuring 15–20 mm, while others advocate for much thinner flap of 2 mm thickness [10, 11]. In our experience, we do not routinely perform this technique unless specifically requested by the patient as the inferior pedicle inevitably leads to undesirable inferior chest contour and residual fullness that often requires revision. This technique would also not be suitable for patients with larger glandular tissue and significant ptosis that will require extensive NAC repositioning. Wolf’s classification notes that this technique would be best fitting for medium sized breast with NAC travel distance of 2–5 cm [10].

Complications, Revisions, and Patient Satisfaction

Overall complications from chest masculinization largely include hematoma, seroma, hypertrophic scar, and wound dehiscence. More recent articles have reported complication rates ranging from 5 to 18.1% [11, 16, 25, 26] with some studies showing higher rates of complications for periareolar technique, in particular regarding seroma and hematoma [15, 18, 26]. Revision rates vary widely from 9 to 60% based on published data with our institutional revision rate of 16.9% [11, 14, 27]. Revisions typically involve standing cone deformity correction, scar revision, and contour deformity correction. Limited standing cone deformity correction and scar revision can be performed in clinic setting with local anesthetic. More significant contour deformity correction often involves additional subcutaneous tissue resection or less frequently fat grafting to address “hollowed-out” deformity. Any revision is typically delayed 4–6 months following the index surgery. Previous studies have shown that TGNC patients after undergoing chest masculinization surgery have shown high satisfaction rate. Many studies have shown patients rating their satisfaction rate as “very good” or “good” [11, 12, 26, 28]. Additionally, the impact of surgical transition on

improved mental health is well documented. [29, 30]. Evidence suggests that high satisfaction, mental health benefit and sense of body congruency continues decades after the index procedure [30].

Other Masculinizing Body Contouring Procedures

Masculinizing procedures of the torso focuses on reshaping of the abdomen and waist. Male torso has less subcutaneous fat deposit around the waist, hip, and buttocks compared to that of female. Waist-to-Hip Ratio (WHR) is often utilized to quantify the waist-hip relationship. While there is not just a single value that is considered as the ideal WHR for male and female, previous studies have shown that attractive female WHR should be around 0.7 while attractive male WHR is higher around 0.8–0.9 [31–33]. Such “boxy” shape of the torso can be achieved by liposuction of the buttock and lateral hips [34]. Male abdominal contour can be improved by liposuction and/or abdominoplasty, depending on the amount of subcutaneous fat deposit and excess skin. Abdominoplasty and lipoabdominoplasty for male patients are done similarly to that of female patients; however, it is important to note a few differences. First, males generally have android shape with intraabdominal fat deposit. This can affect post-operative result so it has to be evaluated and discussed preoperatively. Secondly, waistline should not be accentuated as much as female abdominoplasty; this can be achieved by utilizing a less aggressive arc of the abdominal incision. Lastly, studies have shown that men tend to have higher rates of complications, such as hematoma and seroma, post abdominoplasty when compared to female. While there isn't any study looking at body contouring procedure outcomes comparing female, male, and transmale or transfemale patients, this should be part of the preop discussion as a part of the informed consent [35, 36].

Hormone Therapy (Testosterone)

Hormone therapy has not been shown to increase complication rates after chest masculinizing therapy. However, abrupt cessation of hormone therapy may lead to disruption and worsening dysphoria. Patients undergoing surgery should be assessed for routine venous thromboembolism risk using Caprini score and be treated with appropriate anticoagulants as indicated [37]. Regarding its impact on surgical outcomes, testosterone use enhances the result of chest masculinizing surgery by the anabolic effect on skeletal muscle. Increased pectoralis muscle bulk help build a more muscular shape. This is true for both patients who were on testosterone prior to surgery, as well as, patients who get started on it post-operatively.

Oncologic Concerns

Preoperatively, patients should follow routine breast cancer screening recommendations. Patients over the age of 40 or with significant family history should have a preoperative mammogram performed prior to mastectomy. In addition, patients should be counseled that there may still be residual breast tissue after an affirming mastectomy and that they should continue self-exam for breast cancer surveillance. While chest masculinizing surgery does not completely resect all breast tissue, it is typically not technically feasible to obtain mammogram post-operatively. Hence, self-exam is recommended for surveillance. In an event where an individual undergo a variation of breast reduction with adequate amount of breast tissue left for mammogram, one should consider risk–benefit of cancer surveillance vs. potential dysphoria from mammogram as there is no clearly published evidence-based guideline.

No clear guidelines exist regarding pathologic tissue assessment on patients undergoing chest masculinization. A survey study have shown that there's a wide range of practice regarding the resected glandular tissue [38]. Recent studies have shown that pathologic exam of the breast glandular tissue specimen from chest masculinizing surgery have significantly lower rates of abnormal lesions by 0.4× with overall rates of atypical findings ranging from 1.1 to 2.8% when compared to cis-female patient's reduction mammaplasty tissue specimen [39, 40]. While the rates of abnormal finding are significantly lower in transmasculine population compared to cis-female population, it is advisable to send the specimen for routine pathologic exam, especially for those with higher risk factors.

Chest Feminizing Surgery: Breast Augmentation

Gender affirming top surgery for transfeminine individuals does not differ significantly from surgical options of breast augmentation for ciswomen, with implant augmentation being the mainstay technique and fat grafting as either a primary or adjunctive procedure. WPATH guideline for transfeminine patient's breast augmentation is the same as that of transmasculine individual's guideline for top surgery except that they recommend 1 year of hormone therapy prior to surgery in order to maximize breast growth first [8]. Prior studies have shown that maximal breast development occurs within the first 6 months that plateaus after 2–3 years, with about 7.9 cm ± 3.1 cm mean breast-chest difference after 1 year of hormone therapy; this often times is considered insufficient growth to the patients [41]. If a patient decides to go on estrogen after breast augmentation, they should be aware that it may result in some breast asymmetry or

contour changes. While similar surgical methods are used for both trans and cisgender women breast augmentation, one must note the anatomic differences. Genetic male tend to have more developed chest with wider sternum and higher pectoralis muscle mass. Their NAC tends to be more lateralized with shorter nipple to inframammary fold (IMF) distance [42]. NAC reconstruction is rarely desired, unlike transmasculine top surgery.

Lastly, there's a small but significant portion of transwomen who pursue illicit silicone injections in various body parts including breast, which sometimes is referred to as "pumping". 2015 survey showed a 3% illicit silicone injection use in transgender population; however this rate can be higher in urban populations [43, 44]. Such injection will inevitably lead to multiple complications [45]. Often these patients present with severe breast deformities that are best managed in a staged approach. Surgical resection frequently requires bilateral mastectomy followed by either implant-based or autologous reconstruction [46].

Implant-Based Augmentation

Considerations for implant-based augmentation should include patient goals, implant types and sizes, and incision location. Many patients prefer larger implants when compared to cis-female patients with implant volume greater than 400cc [47, 48]. Access incisions can include IMF, axillary and periareolar. There are multiple systems developed when assessing someone for breast augmentation. One is TEPID system, which advocates for analysis of the five most critical factors in breast augmentation—Tissue characteristics, Envelope, Parenchyma, Implant, and Dynamics [49]. ICE method is a simplified method that uses implant dimensions and breast capacity to calculate the distance by which IMF must be adjusted to achieve ideal breast ratio [50].

Implants may be placed in subglandular, subfascial, or submuscular planes. During the initial assessment, pinch thickness should be measured; typically pinch thickness of at least 2 cm is recommended for subglandular placement to ensure adequate soft tissue coverage over the prosthesis [49]. Debate persists regarding implant plane selection—some have noted that majority of the patients did not have adequate soft tissue coverage despite being on hormones and required submuscular placement [51]. On the contrary, some studies advocated for subglandular placement for better fill [52]. More recent studies have shown higher likelihood for transfeminine breast augmentations to be subglandular implants compared to that of cis-female (51% vs. 7.3%) [47].

In our experience, subglandular placement via an IMF incision provides a number of advantages. The IMF incision enables direct control of the IMF level which often needs to be lowered due to short nipple to fold distances. It also allows for longer incisions compared to the periareolar

approach which facilitates placement of larger silicone implants. Due to the anabolic effect of testosterone on pectoralis major development, the dual-plane submuscular approach can be technically challenging due to the size of the muscle, as well as the larger base diameter dissection required for adequate implant position. In addition, significant animation deformity may develop with this approach. The subglandular pocket more easily accommodates larger implant sizes as well, due to the increased elasticity of the glandular envelope compared to the subpectoral space (Fig. 3).

Complications and Patient Satisfaction

Breast augmentation is very well tolerated with low rates of complication. Reported complication rate for transgender augmentation ranges from 1.8 to 14% [47, 48, 53]. Complication profile includes infection, hematoma, seroma, capsular contracture and medical complications including VTE [47]. While capsular contracture after transfeminine augmentation is not well documented, reported rates are low ranging between 1.4 and 5.6% [47, 48]. This is an area of research that will likely develop more in the coming years with growing GAS numbers and available data. Overall patients have very high satisfaction and improved gender dysphoria [48, 51].

Other Feminizing Body Contouring Procedures

There are various feminizing body contouring procedures that one may choose to pursue. In general, accentuated waistline with full buttock, often referred to as "hourglass look" is desired in transfeminine patients with a desirable WHR of 0.7. Slimmer waist can be achieved by various routine body contouring procedures including panniculectomy, abdominoplasty, and liposuction. Buttock augmentation can be addressed by gluteal and hip implants, liposuction and fat grafting, or a combination of these. Again, these procedures are not unique to TGNC population but there are a number of literatures looking specifically at transgender patients. Cárdenas-Camarena et al. suggested an algorithm based on the fat deposition of hip and gluteal regions [54]. Del Vecchio et al. noted that the average waist-to-hip ratio improvement was 1.11 pre-op to 0.81 after large-volume fat grafting combined with gluteal implants [55]. Overall, published data show high patient satisfaction with low complication profile, with wound dehiscence being the most common post-operative complication after implant-based gluteal augmentation [54–56]. Lastly, rib resection is a surgical technique that aims to create narrower waist and therefore accentuate one's waistline. It often involves surgical removal of 11th and 12th ribs, or the floating ribs. Literature describes both direct excision [57–59] as well as osteotomy alone with corset use

Fig. 3 18 months post-op photos of a patient who underwent bilateral subglandular implant augmentation (465cc implants). IMF was lowered by 1 cm



techniques [60]. While the literature on this technique is scarce with small sample sizes, published data notes generally satisfied patients [58, 60] with low complication rate including 2% risk of pneumothorax [59].

Hormone Therapy (Estrogen)

There have been differing opinions regarding estrogen therapy in perioperative setting. While some groups advocate for stopping estrogen in perioperative period noting the risk for venous thromboembolism, others advocate for continued therapy considering the psychological burden associated with gender dysphoria. [61]. It is important to note that VTE rates for transfeminine individuals are overall low and vary depending on the type of estrogen. Ethinyl estrogen is noted to be associated with higher rate of cardiovascular death, while transdermal estrogen showing the lowest rate of VTE events [62]. Overall, VTE rate

of transgender female on estrogen therapy is still low at 2.3 per 1000 person-year [63]. Surgical team should assess VTE risk using Caprini score and treat appropriately in perioperative period.

Conclusion

Gender affirming surgery of the trunk is a safe and well-tolerated surgical treatment for patients with gender dysphoria. These surgical treatments can easily be combined with medical/ hormone therapy. There are various techniques that one can utilize based on patient's goals, native anatomy and body habitus. Studies have shown that patients often have high satisfaction with improved mental health measures post-operatively.

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Declarations

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