CHARACTERISTICS OF THE ANTEROLATERAL THIGH FLAP IN A WESTERN POPULATION AND ITS APPLICATION IN HEAD AND NECK RECONSTRUCTION

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Abstract: Background. Although the anterolateral thigh flap has been extensively used for head and neck reconstruction in Asia, reported variations of vascular anatomy seem confusing and may have contributed to the unpopularity of this flap in the United States. The purposes of this study are to classify the vascular anatomy and to assess the suitability of this flap for head and neck reconstruction in a Western population.

Methods. Seventy-two consecutive anterolateral thigh flaps for head and neck reconstruction was retrospectively reviewed.

Results. The number of cutaneous perforators for the anterolateral thigh flap ranged from one to three. On the basis of their location and origin, a simple classification system is introduced to assist flap dissection. Of the 72 thighs explored, 68 flaps (94%) were raised successfully.

Conclusions. The vascular anatomy of the flap follows predictable patterns. The anterolateral thigh flap is well suited for head and neck reconstruction in Westerners.

Keywords: head and neck reconstruction; anterolateral thigh flap; perforator flap; flap thickness; body mass index

The anterolateral thigh (ALT) flap has become the flap of choice for many reconstructive surgeons in Japan and Taiwan, particularly for head and neck reconstruction.1–5 There have been few reports, however, from the Western countries about the use of this flap.6,7 It seems that it has not gained similar popularity in the United States. Possible reasons for this might be the variations of vascular anatomy, difficulty of dissection, and the thick thigh fat commonly found in Westerners.7,8 Detailed anatomy and flap thickness among Westerners have not been well documented. The anatomic variations described in the literature seem to be confusing. Over the past 21 months, 72 ALT free flaps were attempted, and 68 were successfully performed for head and neck reconstruction at The University of Texas M. D. Anderson Cancer Center in Houston, Texas. Herein, the characteristics of this flap, as well as surgical techniques, are described. Patterns of vascular anatomy are identified and classified. It is hoped that the simplified classification of vascular anatomy will shorten the learning curve for flap harvesting.

MATERIALS AND METHODS

From October 2001 to June 2003, 72 ALT flaps were attempted in 69 patients, and 68 free flaps...
were successfully performed in 68 patients for head and neck reconstruction (Table 1). There were 50 men and 18 women. The patient’s mean age ± standard deviation (SD) was 63 ± 12 years (range, 38–91 years). Mean body mass index (BMI) ± SD was 25.6 ± 4.4 (range, 18.3–36.0). A small amount of the vastus lateralis muscle was included based on a separate muscular branch in 11 patients. Ten flaps were thinned, 12 were two-skin islands based on separate perforators, 12 were sensate, and 23 were conventional fasciocutaneous flaps.

Operative Technique: Simultaneous Two-Team Approach. The flap is raised as described previously.2,5–7 With the patient in a supine position, the cutaneous perforators around the midpoint between the anterior superior iliac spine (ASIS) and the superolateral corner of the patella are examined with a handheld Doppler. Flap elevation is performed simultaneously with tumor resection by a team of ablative surgeons. Initial flap design is based primarily on the anticipated width of the defect. The estimated flap is marked so that approximately one third of the width is anterior to and one third of the flap length is cephalad to the Doppler signal (Figure 1).

An anterior incision approximately 15 cm long is made, and subfascial dissection proceeds laterally until cutaneous perforators are identified. The intermuscular space is then entered, and the descending branch of the lateral circumflex femoris artery is isolated. With both the cutaneous perforators and the pedicle in view, the perforators are freed. When muscle is needed, various amounts of vastus lateralis muscle around the cutaneous perforator and the descending branch can be included with the flap. The descending branch distal to the last cutaneous perforator to be included in the flap is then divided. At this point, the flap is essentially ready for transfer. All these dissections may be performed through the anterior incision. The flap should not be islanded before identifying and dissecting out the perforators. In the event that no suitable cutaneous perforators can be found, the anterior incision may simply be closed.

Flap design is finalized when the dimension of the defect is known, keeping in mind that the actual perforator location may be more lateral than the Doppler signal suggested. Therefore, the flap may need to be re-centered. The proximal border of the flap is incised last. When a sensate flap is needed, the lateral femoral cutaneous nerve is identified through the proximal incision. The nerve consistently runs along the line connecting the ASIS and superolateral patella in the deep subcutaneous tissue immediately above the fascia. An additional 5 cm of nerve is harvested by subcutaneous dissection.

When needed, flap thinning is performed while the vascular pedicle is still attached or after revascularization. The perforator patterns after it enters the fascia and subcutaneous layer are studied under loupe magnification, as described by others.2,9 The main perforator usually gives off three or more branches that travel above the fascia, deep in the adipose layer, and straight to the subdermal plexus. After identifying the latter, the flap is thinned with direct excision, leaving 1 or 2 mm of fat on the dermis to protect the subdermal plexus and a cuff of tissue around the main perforator.

Measurement of Flap Thickness and Perforator Locations. Before dividing the vascular pedicle, the flap was placed on a flat surface. The thickness of the flap at the anterior border was measured in millimeters with a ruler at three different levels: midway between the ASIS and superolateral patella and 5 cm more proximally and distally.

The following measurements were also performed: (1) the distance between the ASIS and the superolateral patella in centimeters; (2) the distance between the ASIS and the surface location of cutaneous perforators; (3) the pedicle length; (4) the diameters of the pedicle artery and its two venae comitantes; and (5) the size of the cutaneous perforators at their exit from the muscle toward the fascia. The size of the perforators was grouped as large (>1 mm), medium (0.5–1 mm), and small (<0.5 mm). The type

Table 1. Clinical applications of the Anterolateral Thigh Free Flap.

<table>
<thead>
<tr>
<th>Type of defect and reconstruction</th>
<th>No. cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharyngo-esophageal</td>
<td>25</td>
</tr>
<tr>
<td>Tongue</td>
<td>20</td>
</tr>
<tr>
<td>Parotidectomy, auriculectomy, and mastoidectomy defects</td>
<td>7</td>
</tr>
<tr>
<td>Orbitectomy and cranial base</td>
<td>7</td>
</tr>
<tr>
<td>Tongue and mandible in conjunction with a free fibula flap</td>
<td>5</td>
</tr>
<tr>
<td>Posterior mandible</td>
<td>3</td>
</tr>
<tr>
<td>Total lip</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
</tr>
</tbody>
</table>
and origin of the cutaneous perforators were also documented.

Statistics. The data are expressed as mean ± SD. Unpaired, two-tailed Student’s t test and simple regression are used for statistical analysis. A p value less than .05 is considered statistically significant.

RESULTS
The ALT flap was successfully raised on the first attempt in 66 (95.7%) of the 69 patients. In the other three patients, a single cutaneous perforator originated directly from the profundus femoris artery and pierced through the rectus femoris muscle to reach the skin on one thigh. In each case, the perforator was small (<1 mm) at its origin. The descending branch was present in the usual location but did not give off any cutaneous perforators to the thigh skin. Therefore, the contralateral thighs were explored, and the ALT flap was successfully raised in two of the patients. In the third patient, no cutaneous perforators were present on the contralateral thigh, and a free transverse rectus abdominis myocutaneous flap was used instead for an orbitomaxillocranial base reconstruction.
Characteristics and Classification of Cutaneous Perforators. Except one case (1.4%) in which no cutaneous perforators were present, the number of cutaneous perforators ranged from one to three. The cutaneous location of the perforators seems to follow a pattern. The perforator that is most consistently present is located around the midpoint between the ASIS and the superolateral patella, as described previously. The average distance measured from the ASIS is 24.3 ± 5.4 cm. A more distal perforator may be found 28.7 ± 3.5 cm from the ASIS. More proximally, a cutaneous perforator may be found 18.9 ± 3.5 cm from the ASIS. Therefore, these three perforators are approximately 5 cm apart from each other. On the basis of this pattern, the cutaneous perforators may be classified as perforator A (most proximal), perforator B (middle), and perforator C (most distal) (Figure 2). The measured distance between the ASIS and the cutaneous perforators obviously depends on the height of the patient. Therefore, the relative location of each perforator between the ASIS and superolateral patella is determined as shown in Figure 1, with point 0.5 being the midpoint. The location, number, size, and types of perforators are summarized in Table 2.

The number of cutaneous perforators present in each flap averaged 2.04. A single cutaneous perforator was present in 22% (16 of 72) of the thighs explored. Fifty-four percent of the thighs (39 of 72) had two cutaneous perforators, 22% of the thighs (16 of 72) had three cutaneous perforators, and one thigh had no cutaneous perforators (Table 3). The number of perforators taken with the flap averaged 1.66.

The cutaneous perforators seem to derive from three different origins. On the basis of this finding, they may be classified as types I, II, and III (Figure 3). In type I, the cutaneous perforators derive from the descending branch of the lateral circumflex femoris artery, travel either through the intermuscular space (septocutaneous, SC) between the rectus femoris and the vastus lateralis muscles or through a thin layer of vastus lateralis muscle (musculocutaneous, MC) (Figure 2). This is the most common type, accounting for 90% (65 of 72) of the cases. In type II, a single cutaneous perforator, usually perforator B, originates from the transverse branch of the lateral circumflex femoris artery and travels longitudinally within the vastus lateralis muscle for its entire length before it enters the fasciocutaneous flap. Type II accounts for 4% (3 of 72) of the cases and requires tedious intramuscular dissection to free the perforator. The transverse branch was included in each case to obtain a larger size.
pedicle (Figure 4). In type III, a single perforator, also perforator B, derives directly from the profundus femoris artery and pierces through the rectus femoris muscle to reach the fasciocutaneous flap (Figure 5). Type III accounts for 4% (3 of 72) of the cases. Because of the small size of the perforators (<1 mm) in this series, the flap was abandoned in each case, and the contralateral thigh was explored.

Among the 68 successfully raised flaps, 27 flaps (40%) were based on a single perforator, 37 flaps (54%) were based on two perforators, and four flaps (6%) were based on all three perforators (Table 3). Flap width varied from 5 to 11 cm, and flap length varied from 6 to 30 cm, with a mean flap area of 196 \( cm^2 \). The diameter of the descending branch immediately below the rectus femoris branch was consistently larger than 2 mm for the artery and greater than 2.5 mm for one of the venae comitantes. The mean pedicle length was 9.7 \( cm \) if perforator A was included in the flap and 13.2 \( cm \) if perforator B was included.

**Flap Thickness and BMI.** The ALT flap was consistently thicker proximally, becoming progressively thinner distally; the exceptions were very thin flaps (\( \leq 6 \) mm), the thickness of which did not change significantly. The flap thickness was 18.3 \( \pm 8.8 \) mm, 15 \( \pm 7 \) mm, and 12.5 \( \pm 6.4 \) mm at the level of perforator A, B, and C, respectively. Compared with the thickness at the level of perforator B, the flap was 20% \( \pm 14 \% \) thicker at perforator A and 18.4% \( \pm 11.5 \% \) thinner at perforator C. Because perforator B was most consistent, the flap thickness at this location was used for the following comparisons.

The mean flap thickness in female patients was 19.9 \( \pm 6.9 \) mm (\( n = 14 \)), which was significantly greater (\( p = .004 \), Student’s \( t \) test) than that in male patients (12.9 \( \pm 6.0 \) mm, \( n = 32 \)). In contrast, the mean BMI in female patients (24.7 \( \pm 4.3 \)) was slightly lower than that in male patients (26.0 \( \pm 4.4 \)), although the difference was not statistically significant (\( p = .35 \)). As a result, the difference in flap thickness per BMI between male and female patients (0.48 \( \pm 0.17 \) and 0.80 \( \pm 0.20 \), respectively) was even greater (\( p = .0005 \)). Overall, flap thickness correlated with BMI fairly well in this patient population (\( R = 0.6 \), \( p = .0001 \)). The correlation was even greater in the men than it was in the women.

**Clinical Outcomes.** Primary closure of the donor site was achieved in 64 patients (94%), whereas skin grafting was required in four patients. Donor site complications included four seromas, which resolved after needle aspiration; one

| Table 2. Location, number, size, and type of cutaneous perforators and pedicle length. |
|---------------------------------|-----------------|----------------|-----------------|-----------------|----------------|
| Pediciler Presence | Location* cm or point | Perforator Size** Small/Medium/Large | Pedicle Length (cm) |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| A 33 (49%) | 18.9 \( \pm 3.5 \) \( \pm 0.04 \) | 18% / 27% / 55% | 9.7 \( \pm 1.5 \) |
| B 63 (93%) | 24.3 \( \pm 5.4 \) \( \pm 0.04 \) | 17% / 37% / 46% | 13.2 \( \pm 2.2 \) |
| C 43 (63%) | 28.7 \( \pm 3.5 \) \( \pm 0.05 \) | 72% / 19% / 9% | Not measured |

Abbreviations: SC, septocutaneous perforators; MC, musculocutaneous perforators.
*Based on 72 thighs explored.
**Based on 68 flaps raised successfully.

| Table 3. Cutaneous perforators present and based on. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|----------------|
| Perforators | None | A | B | C | A + B | B + C | A + C | A + B + C |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Present* | 1 (1.4%) | 1 (1.4%) | 14 (19.4%) | 1 (1.4%) | 13 (18.1%) | 23 (31.9%) | 3 (4.7%) | 16 (22.2%) |
| Based on** | 0 | 4 (5.9%) | 21 (30.9%) | 2 (2.9%) | 17 (25.0%) | 19 (27.9%) | 1 (1.5%) | 4 (5.9%) |

*Based on 72 thighs explored.
**Based on 68 flaps raised successfully.
hematoma, which required evacuation; and one wound dehiscence. All the patients experienced an area of numbness at the inferolateral thigh (Figure 6). All the flaps were transferred successfully with no flap losses. Venous congestion occurred in two patients owing to perforator compression, which resulted in a small area of flap necrosis (1 × 2 cm) in one patient. All other flaps survived in their entirety.

**DISCUSSION**

Large head and neck defects are commonly reconstructed with the rectus abdominis myocu-

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**FIGURE 3.** Drawing showing three types of anatomic variations of the anterolateral thigh (ALT) flap pedicle. In type I, cutaneous perforators (Pr. A, B, and C) originate from the descending branch (DB). In type II, the cutaneous perforator (Pr. B) originates from the transverse branch (TB). In type III, the cutaneous perforator (Pr. B) originates from the profundus femoris artery (PFA) directly. SFA, superficial femoral artery; LCFA, lateral circumflex femoris artery; AB, ascending branch.

**FIGURE 4.** An intraoperative photograph of the left thigh showing perforator B, originating in the transverse branch independently, running through the vastus lateralis muscle longitudinally for its entire length (10 cm). The overlying muscle had been divided to free the perforator. The transverse branch was taken with the perforator. A separate descending branch can be seen. The motor nerve was identified with a vessel loop.
The RAM flap has a consistent vascular anatomy and provides reliable coverage. In recent years, however, the ALT flap has emerged as the flap of choice for many reconstructive surgeons. On the basis of this series and the experiences of others, the following advantages might explain the rapidly emerging popularity of the ALT flap.

First, minimal donor site morbidity is probably the most attractive feature of this flap, especially in elderly patients with significant comorbidity, as is seen in many patients with head and neck cancer who are smokers with chronic obstructive pulmonary disease (COPD) and minimal pulmonary reserve. Early mobilization and quick recovery decrease postoperative complications and

FIGURE 5. An intraoperative photograph of the right thigh showing perforator B exiting the rectus femoris muscle to enter the skin (A). Following the perforator proximally by splitting the rectus femoris muscle reveals that the perforator is a direct branch of the profundus femoris artery (B).
shorten hospital stay significantly (unpublished observations). Second, moderate thickness of the thigh fat compared with thicker abdominal fat makes the ALT flap better suited for craniofacial reconstruction, with superior aesthetic results. The RAM flap is found to be too thick in many occasions in Westerners. The use of the muscle only with skin grafting often produces large contour asymmetry with subsequent muscle atrophy, especially after radiotherapy. In the author’s experience, the ALT flap has the right amount of thickness, which usually produces excellent long-lasting facial symmetry. Third, the subcutaneous fat of the ALT flap is firmer than the abdominal fat and is, therefore, less likely to descend in time, producing lasting results. Fourth, the flap skin can be split into two skin islands based on two separate cutaneous perforators. One of the skin islands can be used for neck resurfacing when needed, avoiding a second flap. Fifth, various amounts of muscle (vastus lateralis) can be included with the flap, depending on the needs. Sixth, both sensory and motor reinnervation (with vastus lateralis muscle) is possible. Seventh, the easy simultaneous two-team approach saves anesthesia time and allows the reconstructive surgeons to start harvesting the flap early, which compensates for the slight difficulty in raising the ALT flap. Because of these advantages, the ALT flap has become the workhorse for head and neck reconstruction in the author’s practice (Table 1).

Providing coverage alone without aesthetic, functional, and donor-site considerations is less acceptable in modern-day practice. This may be an area in which the ALT flap proves to be advantageous. The main reason for the slow adaptation of this flap in Western countries is the variable and often confusing vascular anatomy described in the literature. Careful observation of the vascular anatomy led to the discovery of the patterns of the cutaneous perforators on which is based a simplified classification proposed in this article to assist surgical dissection. This safe and simple method of flap elevation has greatly shortened the learning curve among the trainees.

Classification of the Vascular Anatomy. Two key steps are involved in elevating the ALT flap. The first step is to locate the cutaneous perforators at the subfascial level where they exit the muscle or septum to enter the fascia. The second is to follow these perforators at the subfascial level to their main pedicle.

The location of the cutaneous perforators was originally described to be in a circle with a 3-cm radius around the midpoint between the ASIS and patella. More cutaneous perforators throughout the ALT flap territory were later discovered, making the anatomy more confusing to beginners. In this series, one to three cutaneous perforators could be found in predictable locations on the thigh, approximately 5 cm apart. They are named as perforator A (most proximal), B (middle), and C (most distal). This simple classification seems
very helpful in teaching trainees where to look for cutaneous perforators without “being lost.”

The next important step is to trace the cutaneous perforators to their origin vessel (ie, the main pedicle of the flap). Numerous variations have been described regarding the origins of these perforators. However, any variation can be viewed as a deviation from the descending branch. In this series, three types of variations are found to affect surgical dissection and, ultimately, the fate of the flap. They are classified as types I, II, and III, as described in the Results section. Type I is the most common type (90%), in which the descending branch sends off one to three cutaneous perforators to the flap. Surgical dissection should be relatively straightforward. Type II accounts for 4% of the cases and requires tedious dissection to free the perforator from the vastus lateralis muscle for its entire length (usually 10 cm). The perforator is usually in the perforator B location and is the only perforator in this series. This was observed in our earlier series as well.7 The transverse branch needs to be taken with the perforator to obtain larger pedicle vessels. In type III, the ALT flap may not be used for free tissue transfer. The cutaneous perforator, usually perforator B, is a direct branch of the profundus femoris vessels. It pierces through the rectus femoris muscle to reach the skin and, therefore, is more anteriorly located. Because of the small caliber and short pedicle length, the flap was abandoned in all three cases (4%). It has been reported, however, that the flap could be converted to an anteromedial thigh flap.13 However, the subcutaneous tissue in the medial thigh is considerably thicker than in the lateral thigh. In addition, one of the 72 thighs did not have any cutaneous perforators. The total number of unavailable flaps was four (5.6%). Similar findings were reported by Kimata et al,3 who found that 5% of their 74 patients did not have cutaneous perforators on which to base the flap.

**ALT Flap Thickness in Westerners.** Because the ALT flap is popular mainly in Asia, where the general population is thinner, it would be interesting to show the differences in flap thickness between the West and East. In one study, the mean flap thickness measured with a real-time ultrasound scanner in a Japanese population (24 male and seven female patients) was 7.1 ± 3.4 mm, although the location was not specified by the author.10 Also, the mean BMI was 20.6 and 23.4 in male and female patients, respectively. In another report from Japan, Koshima et al2 documented a mean flap thickness at the midpoint of 7.5 ± 2.0 mm in 52 male and 10.8 ± 3.3 mm in 22 female patients. In contrast, the mean flap thickness at the anterior border midway between the ASIS and superolateral patella in this series was nearly 13 mm in the male and 20 mm in the female patients, doubling the thickness in the Japanese studies. The patients in this series also had a higher BMI. This series reflected the patient population in Texas and those from many southern states in the United States. Most of the patients with head and neck cancer had experienced significant weight loss when they were seen at our institution. Therefore, the flap thickness and BMI in this series may not truly reflect those in the general population.

The thickness of the flap in Westerners would certainly restrict its use in certain anatomic locations, such as hand and hemiglossectomy defects, unless aggressive thinning is performed. On the contrary, a thicker flap is more desirable for total glossectomy defects and craniofacial reconstruction, for which a rectus abdominis myocutaneous flap is commonly used. In cases in which a thicker sensate flap is needed, not many other options exist. The lateral femoral cutaneous nerve can be incorporated easily with the ALT flap, adding only 5 to 10 minutes of operating time. The ALT flap thickness varies proximally to distally by approximately 20%; therefore, some adjustments can be made, depending on the desired thickness in cases in which there are three perforators to choose from. One-stage flap thinning is possible, although it is more time-consuming and requires meticulous dissection with high magnification following the terminal perforator patterns within the flap. My experience seems to suggest that the ALT flap is well suited for head and neck reconstruction. It can also be used as a pedicled flap for groin, lower abdominal, and perineoscrotal reconstruction.7
acceptable aesthetically in cases in which it is closed properly (Figure 6).

**Technical Points.** As mentioned earlier, only the anterior incision should be made initially. Subfascial dissection is preferred because the included fascia may be used for anchoring purposes or as a second layer closure during flap inseting. The septum between the rectus femoris and the vastus lateralis muscles is usually not well defined in Westerners and is easily missed. It is usually only a line of fatty tissue, a very important landmark because all useful cutaneous perforators are immediately lateral to it. Perforator B should be sought first because it is most consistent. If perforator B is at least 0.5 mm in diameter, including more perforators is not necessary unless two-skin islands based on separate perforators are needed, in which case perforator C is sought next. If perforator C is not available, perforator A is sought. Including perforator A, however, may shorten the vascular pedicle and increase the flap thickness because it is more proximally located. When a cutaneous perforator from the rectus femoris muscle (type III) is encountered early in flap elevation, it is simply divided because, in my experience, it is not useful unless "super-microsurgery" is attempted.13

The main pedicle is usually divided immediately below the rectus femoris branch at which level sufficient pedicle length and caliber can usually be obtained. Muscle necrosis has been reported by taking the rectus femoris branch.13 However, more than one rectus femoris branch is usually present, and muscle necrosis has not been observed in this series. The flap can be raised in 1 hour with some experience. Thicker flaps are more difficult to dissect, because tissue planes are less well defined.

The flap was successfully raised in four patients with known peripheral vascular disease. The quality of the descending branch was quite good in each case, with no evidence of calcification. No angiograms were performed preoperatively. My experience seems to suggest that peripheral vascular disease is not a contraindication for the ALT flap, because the profundus system is usually spared in patients with peripheral vascular disease.

**Donor Site.** The right thigh is preferred for right-handed surgeons. The donor site can be closed primarily in 94% of the cases. Flap width is not the only factor; however, skin tightness may be more important. Many patients with cancer experience weight loss, resulting in more skin laxity in the thighs. Therefore, more patients in the general population may require skin grafting. Placement of a large-bore drain, usually a 19-F Blake drain, is advised to reduce the incidence of seroma formation. The drain is placed in the intermuscular space, but the two muscle groups should not be sutured together over the drain, ensuring that the subcutaneous space and the intermuscular space is drained adequately. The donor site scar was well accepted by all patients in this series. No patients have complained of any functional compromise of the donor extremity, although functional testing was not performed in this series. However, infrequently, minor lower extremity dysfunction has been described in the literature.14,15

**CONCLUSION**

The ALT flap is well suited for head and neck reconstruction, although it is significantly thicker in Westerners. Most of the flaps can be raised with a single attempt within a reasonable time frame, with relative ease and minimal donor site morbidity. Peripheral vascular disease may not be a contraindication to the flap. Familiarization with the patterns of cutaneous perforator location (A, B, and C) helps to identify these vessels. This flap should be considered more often in Western patients because of its many advantages.

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**REFERENCES**

6. Pribaz JJ, Orgill DP, Epstein MD, Sampson CE, Hergru-