

が見られることが多い。理論的には硬組織の再建は硬組織で行うべきであろうが、骨の低形成が軽度な患者では、患者自身が気付いていないことや、骨に対する複雑な手術を望まないことも多い。また、骨切り術などを行うと軟部組織の低形成が強調されてかえって顔面の非対称が目立ってしまうことも報告されている¹⁰⁾。このような患者に対して、顔面に比較的大きな瘢痕を残すような骨移植術や骨延長術などを施すことが果たして良い治療なのか否かは、十分に考慮する必要がある。軟部組織の再建だけで整容的には十分に改善される場合が多いことを踏まえて、治療の方針を決定すべきであろう。

軟部組織再建の方法としては、遊離皮弁、真皮・脂肪移植、脂肪注入の中から組織欠損量に応じて治療法を選択するか、あるいは組み合わせる治療を行うことになる。この中で、真皮・脂肪移植は血管吻合など複雑な手技を必要としないが、採取部に瘢痕が残る、術後の吸収の程度を予想し難い、移植部に硬結を触れる結果となることがある、といった問題点が多い。小さな組織欠損であっても、下床の血行に問題がある場合や、瘢痕組織内であれば、真皮・脂肪移植よりも遊離皮弁を選択した方がより確実な治療が行える。

一方、最近では美容外科手技の発達が著しく、脂肪注入、脂肪吸引の技術や器具も非常に発展している。脂肪注入だけで顔面の大きな低形成が改善されることは少ないとは思われるが、皮弁移植後に脂肪注入を追加したり、過矯正部分に脂肪吸引を行うのは侵襲も少なく、細かな調整も効くため非常に有用である¹¹⁾。マイクロサージャリーを専門とする形成外科医もぜひこのような技術は身につけておくべきであろう。

まとめ

顔面の軟部組織の再建に関して、手術適応、手術方法を中心に述べた。ある程度の硬組織の低形成であれば、軟部組織のみを再建するだけで、整容的には十分に改善できることも多い。方法としては、遊離皮弁が中心となるが、美容外科手技の発達に伴い、脂肪注入法の適応範囲が広がりつつある。

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症 例

乳房再建術後に発症したモンドール病の 3 例

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Key words: モンドール病 乳房再建 索状皮下硬結

はじめに

モンドール病は主として胸腹壁に縦走る索状皮下硬結を主症状とする増殖性脈管炎である。明確な病因は不明とされるが、乳房周囲の外傷や手術が誘因となり発症した症例が報告されている。今回われわれは、乳房再建治療の経過中にモンドール病を発症した 3 症例を経験したので、文献的考察を加えて報告する。

I. 症 例

【症例 1】 40 歳，女性

主訴：右肋骨弓から腹部に及ぶ皮下硬結

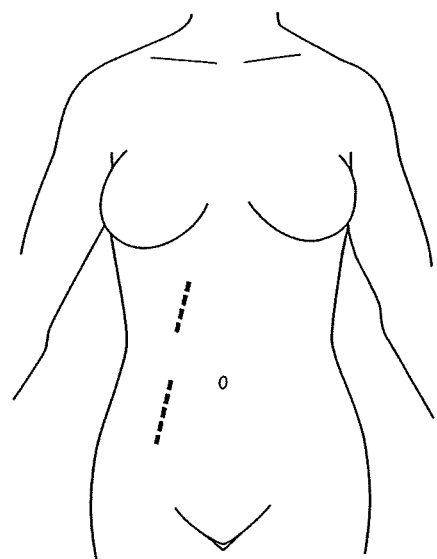
既往歴：初診の 2 年前に左乳癌に対して胸筋温存乳房切除術および腋窩郭清術が施行されている。

家族歴：特記すべき事項なし

現病歴：乳房シリコンインプラントによる左乳房再建および健側の豊胸術を希望し、当科を受診した。

再建に先立ち、初診時より 5 カ月後に左乳

房に tissue expander (round type, 12.5×12.5 cm, 1,000 cc, PMT 社製, アメリカ) を挿入し、10 カ月間の皮膚拡張の後に、乳房シリコンインプラントによる左乳房再建 (Cristalline Paragel, anatomical type, 375 cc, Eurosilicone 社製, フランス) および右乳房豊胸術 (Cristalline Paragel, round type, 180 cc, Eurosilicone 社製) を施行した。術後、徐々に右乳房に Becker 分類 Grade 4 のカプセル拘縮を来とし、インプラントの変形および左乳房の皮膚に炎症を認めたため、再建術より 7 カ月後、右インプラントの抜去術を施行した。



(a) 皮下硬結部位のシェーマ
右肋骨弓および右下腹部に、縦走る皮下硬結を 2 カ所に認める (点線部)。

図 1 症例 1 : 40 歳，女性

† 2009 年 4 月 13 日受領

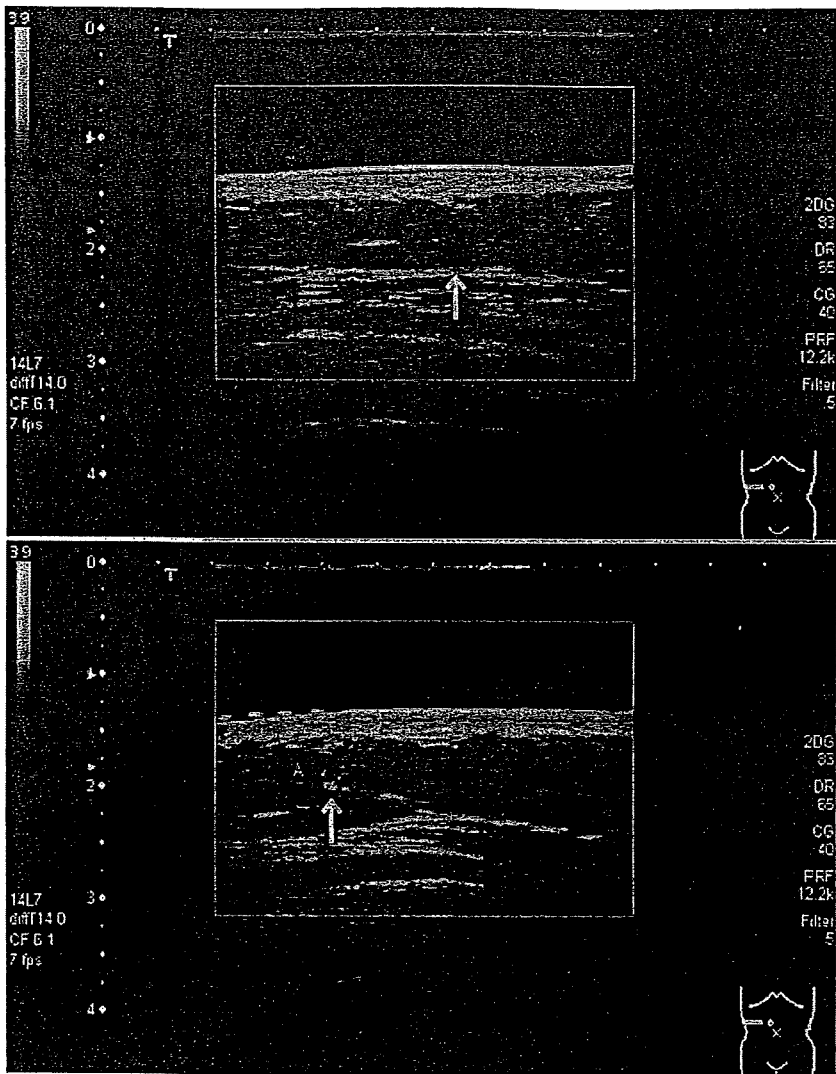
2009 年 7 月 22 日掲載決定

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b
c

(b) 超音波検査所見

硬結を触知する部位と一致して約 6 mm の深さに静脈を描出する。拡張や炎症などの病的な所見は認めない (⇒⇒)。

(c) 超音波検査所見(ドップラーモード)

皮下硬結として触知する部位に、直径約 1.5 mm の静脈の血流が認められる (⇒⇒)。

図 1 症例 1

その後は保存的に炎症および拘縮による変形が改善するのを観察していた。観察期間中の、抜去術より 2 カ月後より徐々に、右肋骨弓から右下腹部にかけて軽度の牽引痛を伴う線状の皮下硬結が出現した。

現症：右肋骨弓から腹部にかけて、軽度の牽引痛を伴う縦走する弾性硬の索状皮下硬結を 2 カ所に認めた (図 1-a)。体表から触知する病変はそれぞれ、長さ 5 cm と長さ 7 cm であった。硬結上の皮膚には発赤・腫脹および自発痛などは認めなかった。

血液検査所見：全経過を通じて、特記すべき異常値を認めなかった。

超音波検査所見：局所の硬結を触知する部位に一致して約 6 mm の深さに静脈様陰影が描出された。口径は 1.5 mm 程度で、拡張や

炎症などの明らかに病的な所見は認められなかった (図 1-b, c)。

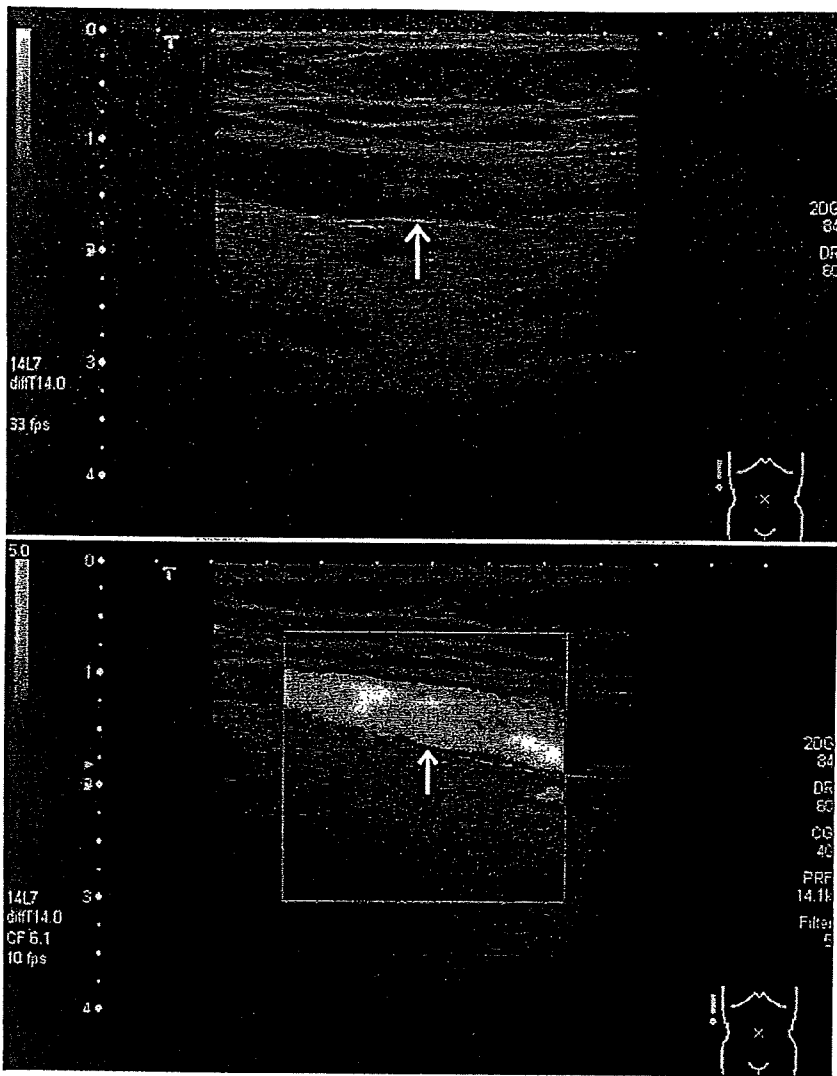
経過：症状および超音波検査所見より、モンドール病と診断し、アセトアミノフェン、セラペプターゼの内服を開始した。3 カ月後、索状皮下硬結は消失し、牽引痛も軽快したため、内服治療を終了した。その後 2 年間経過したが、再発は認めていない。

【症例 2】 49 歳，女性

主訴：右上腕および胸腹部の反復する皮下硬結

家族歴・既往歴：特記すべき事項なし

現病歴：乳房切除術時の一次的再建を目的に、当院外科より紹介となった。上方領域の右乳癌に対して AC 領域の skin sparing mastectomy を施行し、一次的に遊離大網移植術



a
b

- (a) 超音波検査所見
硬結を触知する部位と一致して約1 cmの深さに静脈を描出する。拡張や炎症などの病的な所見は認めない (⇒⇒)。
- (b) 超音波検査所見(ドップラーモード)
皮下硬結として触知する部位に、直径約5 mmの静脈の血流が認められる (⇒⇒)。

図2 症例2：49歳，女性

による乳房再建を行った。術後2週より、大網からの出血により皮下血腫を来たし、感染を合併した。感染は保存的に治癒したが、右乳房の拘縮による変形を来たした。2カ月後、右上腕に牽引痛を伴う索状皮下硬結を2本自覚した。

現症：右上腕に軽度の牽引痛を伴う弾性硬の索状皮下硬結を2カ所に認めた。体表から触知する病変はそれぞれ、長さ2 cmと長さ9 cmであった。硬結上の皮膚には発赤・腫脹および自発痛などは認めなかった。

血液検査所見：全経過を通じて、特記すべき異常値を認めなかった。

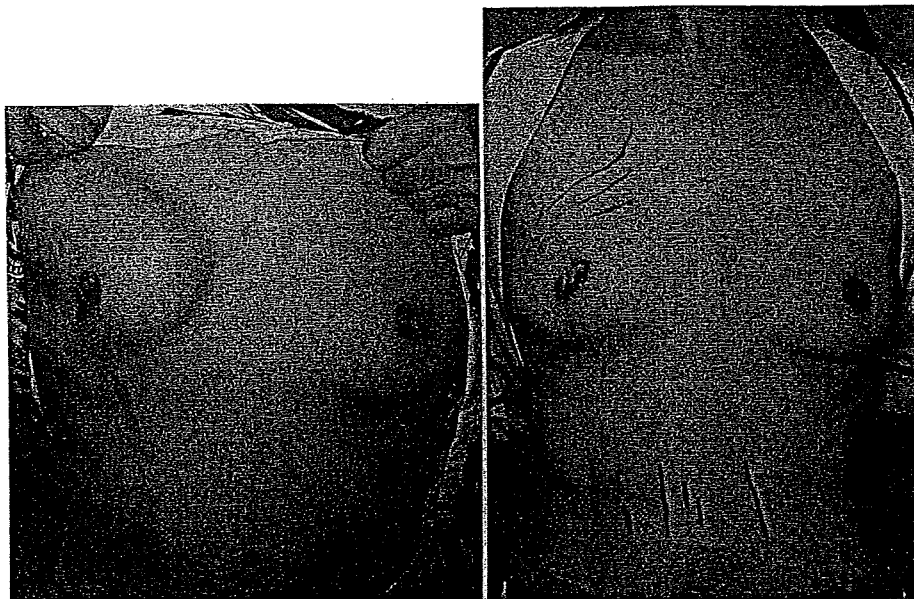
超音波検査所見：3回目の発症時に超音波検査を施行した。索状皮下硬結を触知する部位と一致して、右前胸部から腹部付近に皮下

静脈像が描出された。拡張や炎症などの病的な所見は認められなかった(図2-a, b)。

経過：症状および経過から、皮下硬結の初回発症時にモンドール病と診断し、アセトアミノフェン、セラペプターゼを1カ月間処方したところ、牽引痛および索状皮下硬結は消失した。

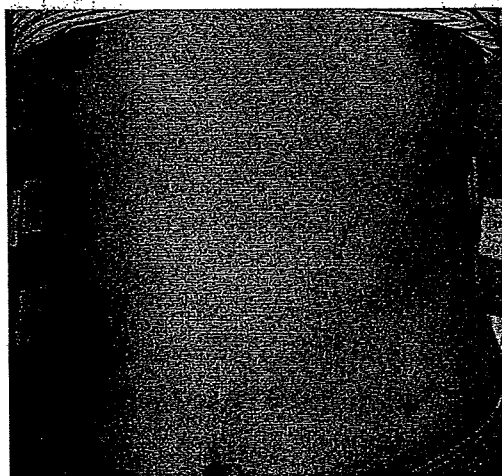
その後、右乳房変形に対して、再度の乳房再建を希望したため、皮膚拡張後の遊離腹直筋皮弁移植術を予定した。

初回手術より1年3カ月後、皮下に tissue expander (rectangular type, 7×12 cm, 290 cc, PMT社製) 挿入術を施行した。5カ月後、右乳房下溝線から尾側に索状皮下硬結が2本出現した(図2-c)。モンドール病の再発と診断し、再度アセトアミノフェン、セラペプター



(c) 2 回目の皮下硬結発症時の状態。右乳房下溝線から尾側に索状皮下硬結を 2 本認めた (点線でマーキング)。(d) 3 回目の皮下硬結発症時の状態。遊離腹直筋皮弁移植術後に、多発する索状皮下硬結を認めた (実線でマーキング)。

図 2 症例 2



(a) 初診時所見

左前胸部から腹部にかけて、軽度の牽引痛を伴う縦走する弾性硬の索状皮下硬結を 3 カ所に認める (点線でマーキング)。

図 3 症例 3：54 歳，女性

ぜを 1 カ月間内服し，皮下硬結は消失した。

挿入術から 9 カ月後，tissue expander を抜去し，筋体温存遊離腹直筋皮弁移植術を施行した。2 カ月後，三たび前胸部から左側腹部にかけて，少なくとも 9 本以上の牽引痛を伴う索状皮下硬結 (長さ 3~18 cm) を認めた (図 2-d)。アセトアミノフェン，セラペプターゼ内服で軽快した。その後 3 年間の経過観察

において，再発は認めていない。

【症例 3】 54 歳，女性

主訴：左前胸部から腹部にかけての索状皮下硬結

家族歴・既往歴：特記すべき事項なし

現病歴：乳房切除術時の一次的再建を目的に，当院外科より紹介となった。上方領域の左乳癌に対して AC 領域の skin sparing mastectomy を施行し，一次的に遊離大網移植術による乳房再建を行った。

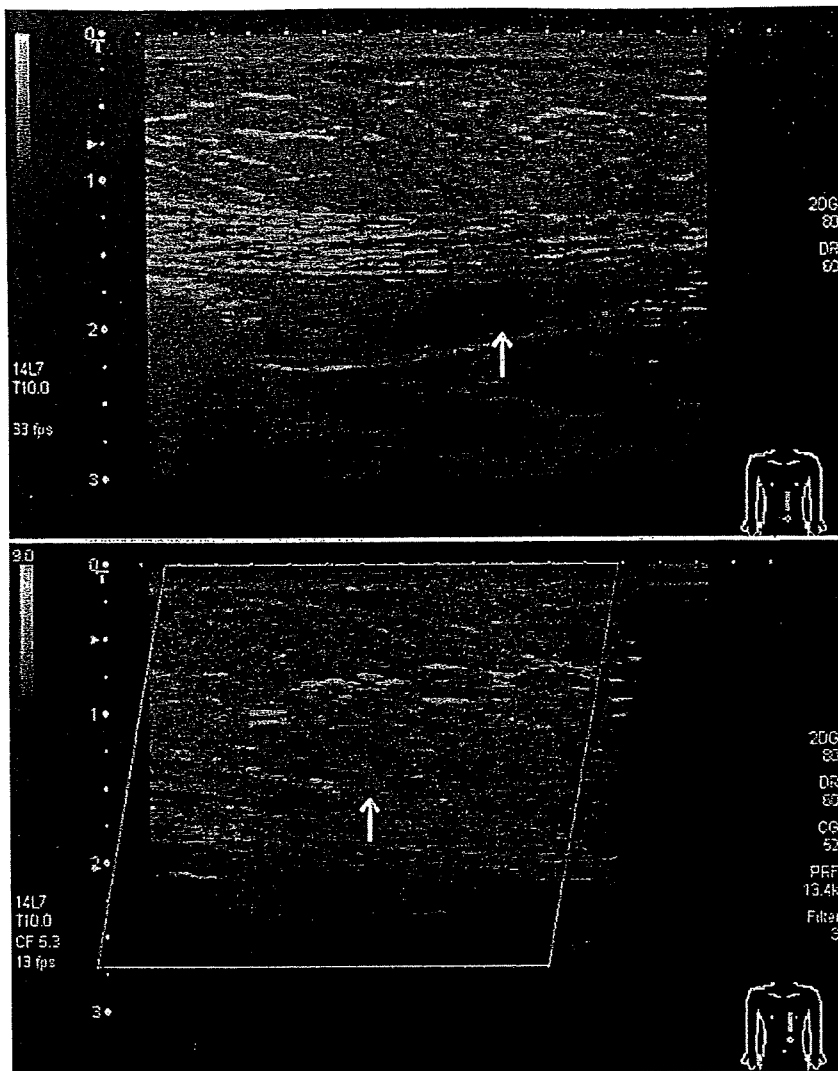
乳房再建より 6 カ月後，左前胸部から腹部にかけて，索状皮下硬結を自覚して受診した。

現症：左前胸部から腹部にかけて，軽度の牽引痛を伴う縦走する弾性硬の索状皮下硬結を 3 カ所に認めた (図 3-a)。長さはそれぞれ，5 cm，8 cm，12 cm であった。

血液検査所見：全経過を通じて特記すべき異常値を認めなかった。

超音波検査所見：硬結を触知する部位と一致して皮下静脈が描出された (図 3-b, c)。

経過：症状および超音波検査所見よりモンドール病と診断し，アセトアミノフェン，セ



b
c

- (b) 超音波検査所見
硬結を触知する部位と一致して約2 cmの深さに静脈を描出する。拡張や炎症などの病的な所見は認めない(⇒⇒)。
- (c) 超音波検査所見(ドップラーモード)
皮下硬結として触知する部位に、直径約2 mmの静脈の血流が認められる(⇒⇒)。

図3 症例3

ラペプターゼの内服を開始した。経過中、索状硬結は徐々に改善傾向を示したが、前胸部の異なる部位に新しく発症、消失を数回繰り返したため、症状に応じて適宜内服を増減した。最終的に、6カ月後、すべての皮下硬結が消失したため、内服治療を終了した。その後2年間の経過観察期間において、再発を認めていない。

II. 考 察

モンドール病は1939年に Mondor¹⁾ が前胸部の索状皮下硬結として報告し、1950年に Kapitanoff がこの病名を冠することを提案して以来、広く用いられている病名である²⁾。わが国では血栓性静脈炎、亜急性性皮下脈管炎

など、ほかの病名が使用されることが多かったが、近年はモンドール病の病名が定着している。モンドール病のわが国での報告例は、新田³⁾ によると1970年から2002年までに251例で、比較的まれな疾患とされている。しかし、自然軽快する良性の疾患であり、自覚症状に乏しい例も多いことを考えると、実際の発症数はもっと多いと推測される。

本症の乳癌に続発する割合は、モンドール病全体の4~12%とされている⁴⁾。乳癌との合併のみならず、乳腺切除術後や放射線照射後に合併する症例もあり、乳腺外科の領域では比較的良好に知られている疾患である。

本疾患はほとんどの場合、1~2カ月で自然消退する予後良好な疾患であり、一過性の可逆的変化であろうと考えられている⁵⁾。

病因は静脈周囲炎，血栓性静脈炎であろうとの説が有力である⁹⁾。

明らかな誘因を認めない原発性のものと，病変周囲の手術，感染症，外傷，悪性腫瘍などが先行する続発性のものがあるが，続発性では誘因の1週間～数カ月後程度で発症することが多い。今回報告した症例もすべて手術後6カ月以内の発症であった。特に，症例2では胸部への手術操作のたびに本症を発症した。

索状皮下硬結は多くが直径1～3 mm，長さ数 cm～数 10 cm の隆起もしくは陥凹する線状のものである。皮膚との可動性は少なく，下床の筋膜とは遊離しているものが多い。色調以外に表面皮膚には通常異常を認めない。

検査所見では，まれに白血球増加を示すことがあるが，通常，炎症反応，血液凝固系検査には異常は認めない。今回の3症例でも，全経過を通じて炎症反応値が増加することはなかった。

超音波検査では硬結の部位に一致して，皮下に索状構造を認める⁹⁾。ドップラーモードで血流を確認できることが多く，診断に有用である⁷⁾⁸⁾。また，周囲の炎症所見は認められない⁹⁾。

過去の報告では，手術が誘因となった例として，乳房切除術¹⁰⁾，乳房固定術¹¹⁾，豊胸術¹²⁾，乳房縮小術¹³⁾などがある。乳房再建に関連する手術後にモンドール病を発症したという報告は，渉獵した限り過去になかった。今回の3症例では，シリコンインプラント除去術，遊離大網移植術，tissue expander 挿入術，遊離腹直筋皮弁移植術と，さまざまな手術操作がモンドール病の誘因となったと考えられる。

本疾患の確定診断は病理所見で増殖性脈管炎を認めることによりなされる⁹⁾が，今回の3症例では整容を目的とした手術後の発症であったため，病理検査に患者は精神的に抵抗を感じ，施行できなかった。臨床経過・所見

とも典型的であったことから，モンドール病と診断した。

治療としては自然消退することが多いため，経過観察されることが多い¹⁴⁾。自覚症状が強い症例に対しては，抗炎症薬の内服投与が行われる¹⁵⁾。自然消退しないものに対して，索状皮下硬結を外科的に切除することもあるが，手術後の続発例や再発例¹⁶⁾もあるため，適応には慎重になる必要がある。特に，今回の3症例のような胸部の整容の手術の術後に続発するような場合は，本疾患を疑い，軽々しく外科的治療を選択することは慎むべきである。

症例1は豊胸術を行った右側に発症しており，乳房再建が直接の誘因ではない可能性が高いが，乳房再建治療の経過中に発症したため，報告した。また，症例2の1回目の発症と，症例3は即時再建後の発症なので，乳癌・乳房切除術・乳房再建のどれが直接の誘因となったかは判別不可能である。しかし，すべて乳房再建の経過中に発症していることから，このような病態の存在は乳房再建や乳房形成術などに携る形成外科医も，念頭に置いておく必要があると考えられた。

まとめ

乳房再建に続発したモンドール病の3症例を報告した。本症は皮膚科，乳腺外科などの領域での報告は多いが，乳房再建に関連して発症したという報告は認められなかった。今後は，乳房再建術が増加傾向にあることから，術後に胸部の索状皮下硬結を認めた際には本疾患を念頭に置いておく必要があると考えた。

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ABSTRACT

Three Cases of Mondor's Disease after Breast Reconstruction

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Mondor's disease is described as thrombophlebitis of the superficial thoracoabdominal veins. The symptoms are usually painful contractions and the subdermal corded indurations in the superficial veins occurring in the sub-mammary region. We report 3 cases of Mondor's disease that occurred after the operation related with the breast reconstruction. These cases occurred several weeks after the operation such as silicon implant removal, tissue expander insertion, muscle-sparing free TRAM flap transfer, and free omentum transfer. All 3 cases were treated conservatively with NSAIDs and recovered spontaneously. This disease generally occurs after breast cancer, mastectomy, infection, trauma, and mammoplasty. There are remarkably few reports of complications after breast reconstruction.

Subdermal corded indurations occurring after the breast reconstruction suggest Mondor's disease, and this disease should be treated with observation and pharmacotherapy such as NSAIDs firstly, not with surgery.

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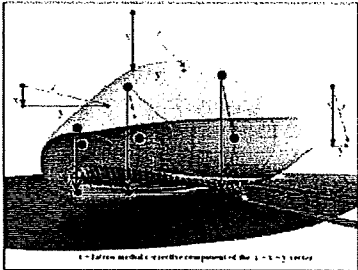
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A new flap design for tongue reconstruction after total or subtotal glossectomy in thin patients[☆]

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KEYWORDS

Tongue reconstruction;
Total glossectomy;
Laryngeal preservation;
Rectus abdominis
musculocutaneous flap

Summary Objective: For tongue reconstruction after total or subtotal glossectomy, a rectus abdominis musculocutaneous flap is often used to obtain sufficient flap volume. However, thin patients often have too little fat tissue to ensure adequate flap volume. For this reason we developed a new flap design to compensate for insufficient flap volume in thin patients.

Methods: In this series, total or subtotal glossectomy was performed in 20 thin men with a mean age of 58.3 years. The patients had a mean body mass index of 18.22 kg/m² and most were considered emaciated. The defects were reconstructed using a rectus abdominis musculocutaneous flap with two skin islands. The first skin island was used to reconstruct the mucosal defect, and the second was de-epithelialised and used to increase flap volume.

Results: Flaps were transferred successfully in 19 out of 20 patients. Most patients could tolerate more than a soft diet without severe aspiration and could engage in conversation. However, four patients required total laryngectomy or a permanent stoma owing to severe aspiration. In this series, the larynx could be preserved in 80% of thin patients, and satisfactory postoperative oral function was obtained.

Conclusion: The most important point for obtaining satisfactory oral function is to reconstruct a tongue with a protuberant shape and sufficient volume. We could maintain sufficient flap volume with the de-epithelialised skin island of a rectus abdominis musculocutaneous free flap. We believe our new flap design is effective for tongue reconstruction in thin patients.

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Ablative surgery with an adequate surgical margin and immediate reconstruction is the first choice of treatment for advanced tongue cancer. The goals of tongue reconstruction are the resurfacing of the mucosal defect and the restoration of oral functions, such as swallowing, deglutition, and speech. To obtain satisfactory function after tongue reconstruction, several important points must be considered. In our experience, one of the most important points is reconstructing the tongue with a protuberant shape.¹ To create a protuberant shape, we usually employ a rectus abdominis musculocutaneous (RAMC) flap, which is a wide, thick flap with sufficient fat volume. However, flap volume may be insufficient in thin patients. In this report we describe our new reconstructive procedure that employs a RAMC with two skin islands to obtain adequate flap volume and a protuberant tongue shape in thin patients.

Materials and methods

Details of operative procedures are as follows. During the operation, cancer ablation and flap elevation were performed simultaneously with a two-team approach. The main point of our surgical procedure is to compensate for the insufficiency of flap volume with a two-island RAMC flap. The first skin island of the flap was designed to be as wide and thick as possible while still allowing primary closure of the donor site (Figure 1). The width of the first skin island was 8.5 to 9.5 cm in most patients. This first skin island was used to reconstruct the surface of the tongue. The second skin island was smaller and was 6.0 to 8.0 cm wide in most patients. The second island was de-epithelialised and used to increase flap volume (Figure 2). After the flap was elevated, the cutaneous portion of the first skin island was sutured circumferentially to the oral and pharyngeal defect using a 4/0 monofilament absorbable suture. Microvascular anastomosis was then performed, and haemostasis of the flap was confirmed. After reperfusion, the de-epithelialised island was inserted beneath the first island and fixed roughly to the surrounding tissue at the tongue base. Finally, laryngeal suspension was added. Our procedure was used for reconstruction in patients in whom bimanual measurement suggested a flap thickness of less than 10 mm.

From 1997 to 2005, 20 thin patients underwent subtotal or total glossectomy followed by immediate reconstruction

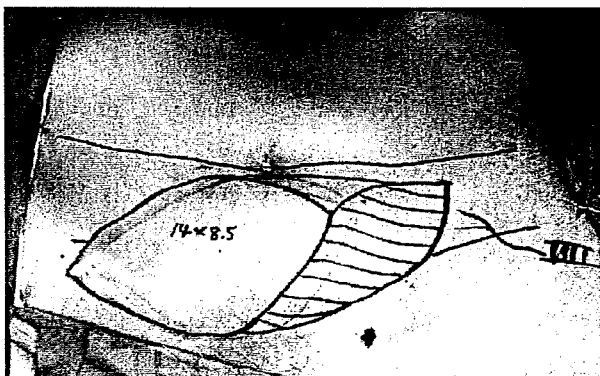


Figure 1 A two-island RAMC flap was designed. The diagonal lines indicate the second island.

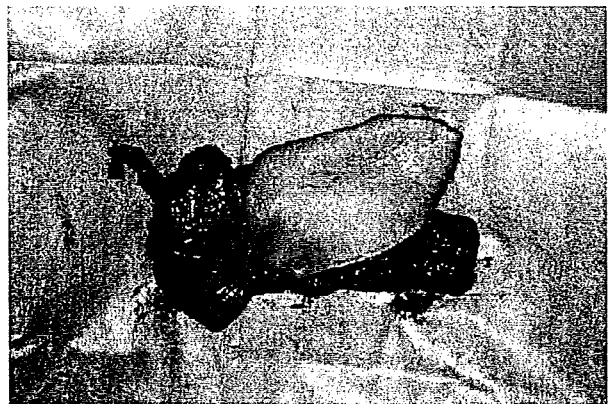


Figure 2 The elevated flap is shown. The second island was de-epithelialised.

using our new technique. The patients ranged in age from 30 to 78 years, with a mean age of 58.3 years. All patients had advanced primary cancer or recurrent disease and underwent either total glossectomy (seven patients) or subtotal glossectomy (13 patients). After surgery, oral functions were evaluated with regard to type of food and speech intelligibility. Speech intelligibility was evaluated with Hirose's 10-point Japanese scoring system.²

Results

The body mass index (BMI) of the patients ranged from 16.1 to 20.7 kg/m² (mean, 18.22 kg/m²), and most patients were judged to be emaciated. The elevated flap was less than 10 mm thick in most patients. Laryngeal suspension was performed in 18 patients, and a temporary tracheal stoma was created in all patients (Table 1). Flaps were transferred successfully in 19 out of 20 patients. Venous thrombosis developed in two patients: total flap necrosis occurred in one of these patients, but the flap in the other patient was salvaged via venous re-anastomosis. Partial necrosis of the flap developed in three patients. Minor orocutaneous fistulae developed in three patients but healed with conservative treatment. A major orocutaneous fistula developed in one patient and required surgical debridement. Oral feeding was started from 7 to 54 days after surgery (median, 10 days). Postoperative aspiration was not observed in eight patients. However, the larynx could not be preserved in four of the remaining 12 patients with aspiration. Of these, two patients required total laryngectomy and another two required permanent tracheal stoma. Decannulation was possible in 16 out of 20 patients 9 to 37 days after surgery (mean, 18.4 days). Therefore, the rate of larynx preservation in this series was 80%. Postoperative oral functions were evaluated as follows. Three patients could eat a normal diet, 11 could eat a soft or pureed diet, one could eat a liquid diet, and two required tube feeding. Speech intelligibility was assessed in 10 patients and was judged to be satisfactory in nine patients (excellent in three patients and moderate in six), and poor in one patient. At the end of the follow-up period (mean duration, 30.9 months; range, 1 to 96 months), only two of 20 patients were alive without recurrent disease (Table 2).

Table 1 Details of patients

Patient	Age (years)	Diagnosis	TN class	Stage	BMI (kg/m ²)	Glossectomy	1st skin island (cm ²)	2nd skin island (cm ²)	Flap thickness (mm)
1	54	Tongue/oesophagus cancer	T3N2b3	4	18.2	Subtotal	6 × 15	Uncertain	3
2	73	Tongue cancer	T4N1	4	18.0	Subtotal	8 × 15	6 × 9	4
3	73	Tongue cancer	T4N0	4	18.1	Subtotal	11 × 14	Uncertain	Uncertain
4	43	Tongue cancer	T3N2b3	4	19.2	Subtotal	9 × 16	8 × 12	Uncertain
5	66	Tongue base cancer	T3N2c	4	18.6	Total	8.5 × 15	6 × 10	5
6	72	Tongue cancer	T4N2b	4	16.4	Subtotal	9.5 × 17	7 × 14	5
7	66	Tongue cancer	T4N2b	4	17.6	Total	8.5 × 14	7 × 10	Uncertain
8	63	Tongue cancer	T3N2b3	3	16.0	Subtotal	8 × 14	6 × 12	10
9	72	Oral floor cancer	T4N2c	4	20.7	Total	9 × 14	7 × 12	10
10	45	Tongue cancer	T4N2c	4	18.2	Subtotal	Uncertain	Uncertain	Uncertain
11	78	Tongue cancer	T4N2b	4	18.1	Subtotal	8 × 14	6 × 12	5
12	72	Tongue cancer	T3N1	3	19.1	Subtotal	8 × 14	7 × 15	7
13	35	Tongue cancer	T3N2b3	4	19.7	Subtotal	8.5 × 16	6 × 14	Uncertain
14	63	Tongue/hypopharynx cancer	T4N2c	4	15.4	Total	10 × 18	6 × 10	4
15	40	Tongue cancer	T4N2c	4	18.9	Subtotal	9 × 14	8 × 10	Uncertain
16	53	Tongue cancer	Rec	Rec	17.4	Subtotal	9.5 × 13	7 × 12	5
17	56	Tongue cancer	T4N1	4	19.4	Subtotal	8 × 12	10 × 10	8
18	30	Tongue cancer	Rec	Rec	17.9	Total	8 × 11	7 × 7	Uncertain
19	56	Tongue cancer	T4N2b	4	19.6	Total	9 × 12	8 × 12	7
20	55	Tongue base cancer	T3N1	3	17.8	Subtotal	Uncertain	Uncertain	Uncertain

Rec, recurrent cancer.

Table 2 Transferred flaps and postoperative results

Patient	Surgical site complication	Start oral feeding (POD)	Tracheal stoma closure (POD)	Food	Conversation (Hirose's score)	Outcome	Follow up (months)
1	Wound infection	10	12	Soft	NA	DOD	31
2	None	10	Permanent stoma	Tube feeding	Moderate (7)	NED	96
3	Partial necrosis	54	Total laryngectomy	NA	NA	AWD	3
4	None	7	11	Normal	moderate (7)	AWD	24
5	Minor fistula	51	Total laryngectomy	NA	MA	AWD	32
6	Minor fistula	8	9	Soft	NA	DOD	6
7	None	7	16	Pureed	Moderate (6)	DOD	3
8	None	12	14	Soft	Moderate (7)	AWD	6
9	Wound infection	35	28	Liquid	NA	AWD	6
10	None	8	11	Soft	NA	AWD	5
11	Lymphorrhoea	14	22	Soft	NA	AWD	11
12	Total necrosis (venous thrombosis)	14	37	Tube feeding	Poor	AWD	11
13	Partial necrosis	30	35	Pureed	NA	DOD	10
14	Partial necrosis major fistula	8	Permanent stoma	NA	NA	DOD	1
15	None	17	15	Soft	Moderate (7)	AWD	12
16	None	8	14	Pureed	Moderate (6)	DOD	11
17	None	8	14	Soft	Excellent (9)	DOD	4
18	None	8	18	Soft	NA	DOD	20
19	None	7	20	Normal	Excellent (8)	DOD	15
20	Venous thrombosis (rescued)	10	18	Normal	Excellent (8)	NED	13

POD, postoperative days; NA, not assessed; DOD, died of disease; NED, no evidence of disease; AWD, alive with disease.

Representative case

Patient 7 was a 66-year-old man with T4N2b tongue cancer. The tumour was located at the left margin of the tongue and extended beyond the midline (Figure 3). Ablative surgery was performed with total glossectomy, bilateral modified neck dissection, and marginal mandibulectomy (Figure 4). The defect of the tongue was reconstructed with a two-island RAMC free flap according to the procedure described above. At the end of surgery, a temporary tracheal stoma was created. The shape of the reconstructed tongue was protuberant at the end of surgery (Figure 5a). The postoperative course was uneventful, and the patient started oral feeding 7 days after surgery. The tracheal stoma was closed 9 days postoperatively, and the patient was discharged 14 days postoperatively. The shape of the reconstructed tongue was semiprotuberant 3 months after surgery (Figure 5b), and the patient could eat a pureed diet with occasional aspiration. The patient's speech was judged to be moderately intelligible. However, the patient died of distant metastasis 4.5 months after surgery.

Discussion

Historically, tongue reconstruction after total or subtotal glossectomy has been a challenging problem. In the early 1970s the most commonly used reconstructive method after total glossectomy was primary closure with subtotal mandibulectomy or with a local flap, such as a lip flap or a forehead flap.^{3,4} At that time, total laryngectomy was



Figure 3 Preoperative magnetic resonance indicated that the tongue cancer had extended beyond the midline of the tongue.

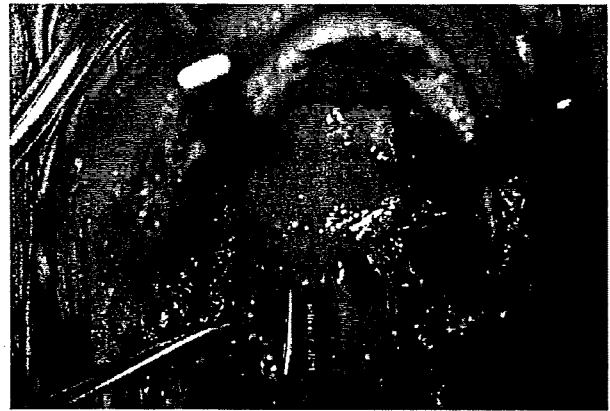


Figure 4 Total glossectomy, bilateral neck dissection, and marginal mandibulectomy were performed.

also believed to be required after total glossectomy, even if the cancer did not involve the larynx.⁴ Also, this method of tongue reconstruction could not provide enough postoperative oral function. Development of the pectoralis major myocutaneous (PMMC) flap in 1979 led to a revolution in

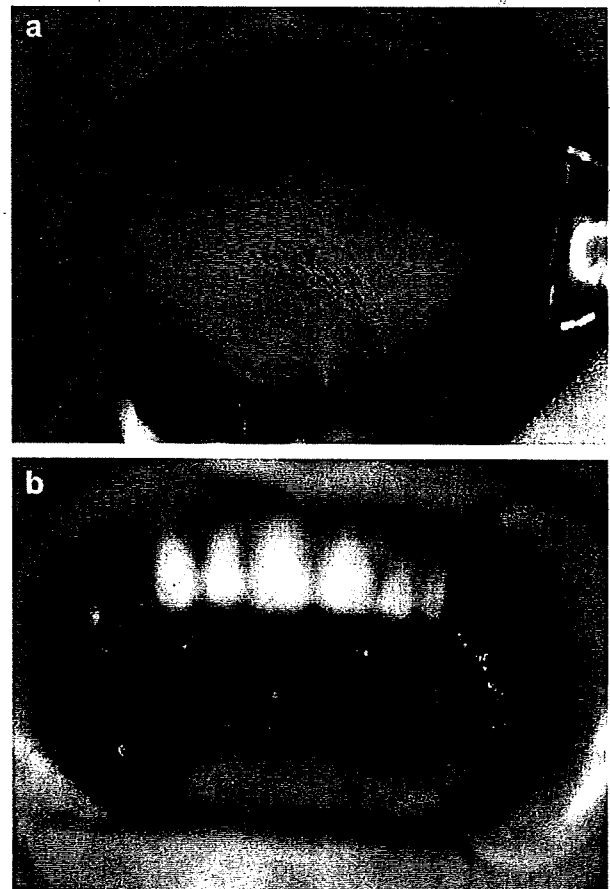


Figure 5 (a) Oral examination immediately after surgery shows the protuberant shape of the reconstructed tongue. (b) Oral examination 3 months after surgery shows a loss of flap volume.

tongue reconstruction.⁵ Following the introduction of the PMMC flap, larynx preservation in patients with total glossectomy was shown to be worthwhile by Effron et al. and Pradhan in the early 1980s.^{6,7} Furthermore, the development of free flaps, including the radial forearm flap, RAMC flap, and anterolateral thigh flap allowed us to provide better postoperative oral function. Following these advances in tongue reconstruction, larynx preservation was shown to be worthwhile, and the larynx preservation rate improved to 70%, as we have reported previously.⁸

To obtain satisfactory oral function after tongue reconstruction and to preserve the larynx, several important points must be considered. In particular, laryngeal suspension and the transfer of a flap with sufficient bulk are important operative techniques. In 2003, we reported the relationship between the shape of the reconstructed tongue (protuberant, semiprotuberant, flat and depressed) and postoperative functions.¹ Excellent function was obtained in patients with protuberant tongues. After total or subtotal glossectomy, we prefer to use an RAMC flap with sufficient fat tissue to reconstruct a tongue with a protuberant shape. However, obtaining a flap with sufficient volume is difficult in thin patients. In this study we compensated for insufficient flap volume by using a free two-island RAMC flap.

Several procedures to compensate for insufficient flap volume can be considered. One is folding a transferred flap and creating a projection with a dog ear.⁹ However, a folded flap requires a three-point suture, which greatly increases the risk of postoperative fistula. Another possible procedure is to transfer multiple free flaps to increase soft tissue volume. Disadvantages of transferring an additional flap are increases in the complexity of the procedure, operation time, the number of vascular anastomoses, and surgical invasiveness. In contrast, our method is simple, requires no additional vascular anastomoses, and allows the flap donor site to be closed primarily. Another possible consideration for tongue reconstruction is dynamic reconstruction with neural anastomosis between a motor nerve of the transferred flap and the hypoglossal nerve.¹⁰ However, we suspect that such a procedure is not practical, because contraction of the transferred muscle might not start for 6 months or more.

Postoperative oral function in the present series was generally good, with most patients able to resume their daily lives about 10 days after surgery; however, four patients required total laryngectomy or permanent stoma. Most patients could tolerate more than a soft diet without severe aspiration and could engage in conversation. We believe that larynx preservation is possible even in thin patients using our new technique. Our new flap design is effective for obtaining satisfactory postoperative function.

However, our new technique has several important limitations. One is patient age. In our series, patients in whom the larynx could not be preserved were older than other patients. We believe that an age greater than 70 years is a limiting factor for laryngeal preservation after total or subtotal glossectomy. In such cases, persistent aspiration can decrease the quality of the patient's remaining life. Candidates for laryngeal preservation must be carefully screened, especially if they have preoperative cerebral dysfunction or silent aspiration due to a poor cough reflex. Another important limitation is a poor prognosis. In our series most patients died within 2 years of surgery. This result suggests that a low BMI due to preoperative weight loss indicates a poor prognosis. Therefore, indications for surgical intervention must be carefully considered in patients with advanced tongue cancer and severe weight loss.

In conclusion, for satisfactory oral function, the reconstructed tongue should have a protuberant shape and sufficient volume. We could obtain sufficient flap volume using a two-island RAMC flap with our new flap design. We believe our new technique is effective for tongue reconstruction and laryngeal preservation in thin patients.

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HEAD AND NECK RECONSTRUCTION WITH THE DEEP INFERIOR EPIGASTRIC PERFORATOR FLAP: A REPORT OF TWO CASES

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Rectus abdominis musculocutaneous (RAMC) free flaps are preferred for head and neck reconstruction because of the abundant blood supply to the rectus abdominis musculocutaneous. In contrast, the indications for deep inferior epigastric perforator (DIEP) free flaps in head and neck reconstruction are limited. In this report, two cases of oral cavity reconstruction with DIEP free flaps are described. In both cases, the defect was reconstructed with a DIEP free flap because it could avoid functional damage to the donor site. Successful reconstruction with a two skin-island method was performed in both patients. Furthermore, donor site morbidity was minimal in both patients. When a DIEP free flap is used for head and neck reconstruction, elimination of dead space is the most difficult problem, because a DIEP free flap does not contain well-vascularized muscle tissue. We compensate for this disadvantage with a flap designed to include a de-epithelialized skin flap. Although this technique is not always the first choice for head and neck reconstruction, it is suitable for patients who wish to avoid donor site morbidity. © 2009 Wiley-Liss, Inc. *Microsurgery* 29:287–292, 2009.

In head and neck cancer surgery, tumor ablation is often performed with a pull-through method, simultaneously with cervical lymph node dissection. In such cases, a defect of the oral cavity communicates with the neck defect, and a large dead space is left in the submandibular region. As a result, postoperative complications, such as wound infections and orocutaneous fistulae, frequently develop. To prevent postoperative complications in head and neck reconstruction, careful blockage of the communication between the oral cavity and the neck defect is important. Furthermore, elimination of dead space is another key for successful reconstruction. For this reason, we prefer to use well-vascularized muscle tissue, such as the muscular portion of a rectus abdominis musculocutaneous (RAMC) free flap and anterolateral thigh (ALT) free flap with vastus lateralis muscle. The rich blood supply of muscle tissue is important to prevent chronic orocutaneous fistula and osteomyelitis of mandible, in case of postoperative leakage. On the other hand, perforator flaps consist only of skin, adipose tissue, and a vascular pedicle and lack well-vascularized muscle tissue. Therefore, procedures for eliminating the dead space and isolating the neck defect from the oral cavity must be considered when a perforator flap is used for head and neck reconstruction.

In this report, two cases of head and neck reconstruction with deep inferior epigastric perforator (DIEP) free flaps are described. Our surgical technique for addressing

the pull-through defect in head and neck reconstruction with a perforator flap is also described.

CASE REPORT

Case 1

A 36-year-old woman was referred to the National Cancer Center Hospital East with swelling and a firm mass of the right cheek. Preoperative examination revealed that a tumor had invaded the pterygopalatine fossa; the tumor was diagnosed as T3N0 buccal mucosal cancer (Fig. 1). Surgery was performed under general anesthesia. Resection of the primary tumor with a pull-through method was performed simultaneously with right cervical lymph node dissection and mandibular marginal resection. Tumor ablation resulted in a defect of the buccal mucosa in the oral cavity and dead spaces in the subtemporal fossa and submandibular region. A bulky soft-tissue free flap, such as an RAMC flap, was considered for reconstruction of the large-volume defect. However, because the patient strongly desired to become pregnant in the future, an RAMC was contraindicated. Therefore, a DIEP free flap was chosen so that the supporting function of the abdominal wall could be preserved.

A DIEP free flap was harvested according to Blondeel report.¹ Before the operation, cutaneous perforators were evaluated with color Doppler flowmetry, and their locations were marked on the abdominal skin. A skin flap was designed as two connected island flaps measuring combine for 7 × 14 cm: one for resurfacing the defect of the oral cavity and the other—a de-epithelialized skin flap—for eliminating the dead space. The perforator was carefully separated from the muscle with minimal invasion, and the intercostal motor nerves were preserved during flap elevation. The donor site was closed primarily with monofilament nylon sutures. After the skin perfora-

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Figure 1. White arrows indicate magnetic resonance findings. A solid mass was present between the cheek skin and the buccal mucosa. The tumor had invaded far into the pterygopalatine fossa. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]

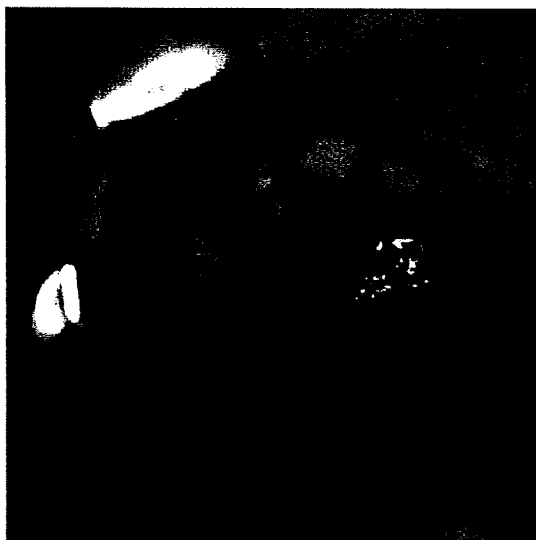


Figure 2. A flap is divided into two connecting island flaps: a skin flap for resurfacing the defect of the oral cavity. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]



Figure 3. The dotted line indicates a de-epithelialized flap—for filling the dead space. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]

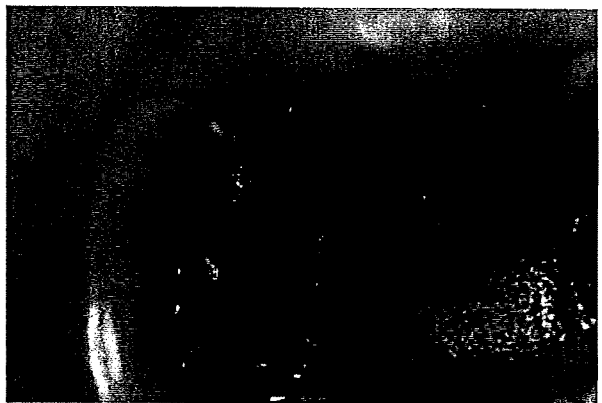


Figure 4. Six months after surgery. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]

tor and the proximal inferior epigastric artery had been dissected, the flap was transferred to the neck and sutured to the buccal mucosal defect with an absorption monofilament suture partly by gambee suture technique (Fig. 2). Next, microvascular anastomosis was performed between the flap vessels and the superior thyroid artery and the internal jugular vein. A de-epithelialized skin flap was placed in the dead space and fixed to the surrounding tissue with anchoring sutures (Fig. 3). A de-epithelialized skin flap was placed behind the intraoral lining for additional reinforcement. At the end of the operation, a negative sealed drain was placed, and the neck skin was closed primarily.

Postoperatively, there was no infection or leakage, and the grafted flap successfully adapted to the defect (Fig. 4). The patient started oral feeding with a pureed diet on postoperative day 7. After several weeks, the

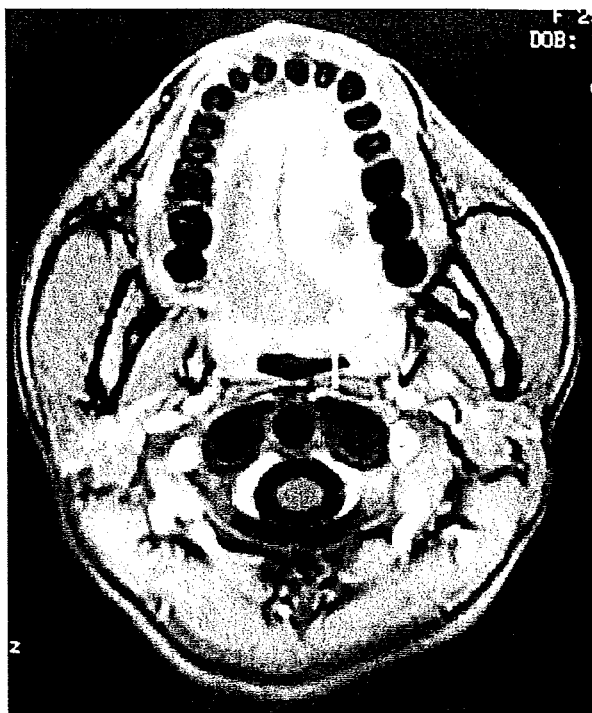


Figure 5. White arrows indicate magnetic resonance findings. A solid mass was seen in the left side of the tongue. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]

patient could eat a regular diet and had achieved satisfactory speech function. No specific complications, such as hernia or abdominal bulging, were observed at the flap donor site 18 months postoperatively.

Case 2

A 25-year-old woman with a painful T2N0 tongue cancer (Fig. 5) was referred to our hospital. The primary tumor was resected by means of subtotal glossectomy using a pull-through method, and simultaneous left cervical lymph node dissection was performed. A tumor was pathologically, well-differentiate squamous cell carcinoma with highly keratinization and complete resection of tongue cancer and adequate surgical margin was confirmed. Tumor ablation resulted in a defect of the 7-cm width in oral tongue and the quarter tongue base that communicated with the neck and in dead space in the submandibular region. Before reconstruction, a part of tongue base defect was closed with a few stitches.

Because the patient was a professional volleyball player who wished to avoid abdominal weakening, a DIEP free flap was chosen for reconstruction of the large-volume defect. As in the previous case, the loca-

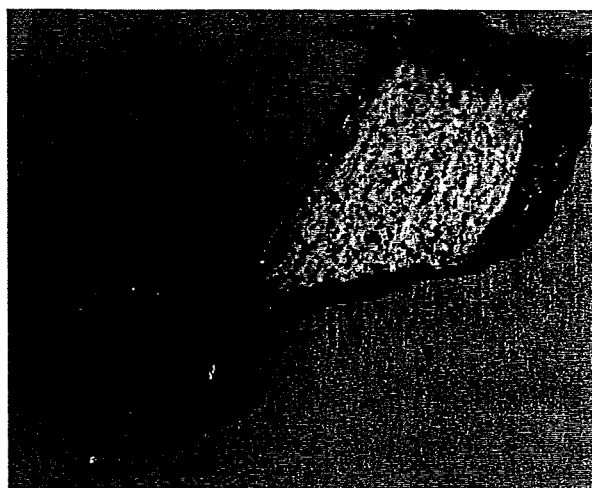


Figure 6. A flap is divided into two connecting island flaps. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]



Figure 7. A skin flap for resurfacing the defect of the oral cavity. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]

tions of cutaneous perforators were identified and marked on the abdominal skin before the operation.

A skin flap was designed as two connected island flaps measuring 7×12 and 2×5 cm: one for resurfacing the defect in the glossal mucosa and the other—a de-epithelialized skin flap—for eliminating the dead space (Fig. 6). The flap was elevated with minimal surgical stress to the muscle, and the intercostal motor nerves were preserved. The donor site was closed primarily. The flap was transferred to the neck and sutured to the glossal mucosal defect as same as case 1 (Fig. 7), and microvascular anastomosis was performed between the flap vessels and the superior thyroid artery and the internal jugular



Figure 8. The dotted line indicates a de-epithelialized flap—for filling the dead space. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]



Figure 9. Eighteen months after surgery. [Color figure can be viewed in the online issue which is available at www.interscience.wiley.com.]

vein. A de-epithelialized skin flap was used to fill the dead space and to reinforce the mucosal lining from behind (Fig. 8).

Although infection and bleeding were observed 7 days after surgery, and surgical hemostasis was required, the transferred flap successfully adapted to the defect (Fig. 9). Six months after surgery, the patient could tolerate a nearly regular diet without swallowing difficulty and aspiration. And also the patient had achieved satisfactory speech function. There were no complications at the donor site. Although there was a transient weakening of the abdominal muscles, the patient could return to work as a professional volleyball player. Finally, the patient could engage in full-intensity daily training.

DISCUSSION

The most important goal of head and neck reconstruction is satisfactory postoperative function. To achieve this goal, various free flaps can be selected according to their volume or composition to reconstruct defects of soft tissue and bone. Another important goal is avoiding postoperative complications. For this reason, the tunnel between the oral cavity and the neck defect after cancer ablation should be sealed with a pull-through method. Blocking communication between the oral cavity and the neck defect helps prevent postoperative fistulae and infections. For secure blockage of the head and neck dead space, transfer of well-vascularized muscle tissue is indicated. For this purpose, we often use a free RAMC flap. However, impaired function and morbidity at the abdominal donor site have been reported. For example, Blondeel et al.^{2,3} have reported various complications after elevation of RAMC free flaps, including abdominal wall deformity, postoperative hernia, impaired abdominal flexion,

extension, and rotation, and disturbance of muscle coordination in the abdominal wall. Such problems would be a particular disadvantage for a patient who is a physical laborer or an athlete or who wishes to become pregnant. To overcome these types of donor site morbidity, RAMC free flaps without abdominal muscles, for example, the DIEP free flap, were developed.

On the other hand, a usage of ALT free flaps and radial forearm free flaps were discussed. Although radial forearm flap is a good option for head and neck reconstruction, there still exists unsatisfactory cosmetic result of skin graft on the forearm or sacrificing major artery. In this series, the size of defect after tumor ablation was rather wider for ALT flaps to use, because ALT flaps have a limitation in its width if its donor site tended to close primarily.

The DIEP free flap was first described by Koshima and Soeda⁴ in 1989, and has since been used to reconstruct oral and groin defects. The DIEP free flap is also preferred for autologous breast reconstruction, because its volume can easily be adjusted to achieve a satisfactory breast shape. A DIEP free flap can be harvested with minimal surgical stress to the abdominal muscles so that dysfunction at the donor site can be avoided. Although the RAMC free flap contains well-vascularized muscle, which is beneficial for head and neck reconstruction, certain patients wish to avoid abdominal wall impairment. For such patients, a DIEP free flap can be chosen for reconstructive procedures. However, special techniques are needed to securely block the dead space when a DIEP free flap without muscle tissue is used.

Effectively blocking the communication between the oral cavity and the neck has been considered difficult without using well-vascularized muscle. However, this problem can be addressed through flap design. Koshima

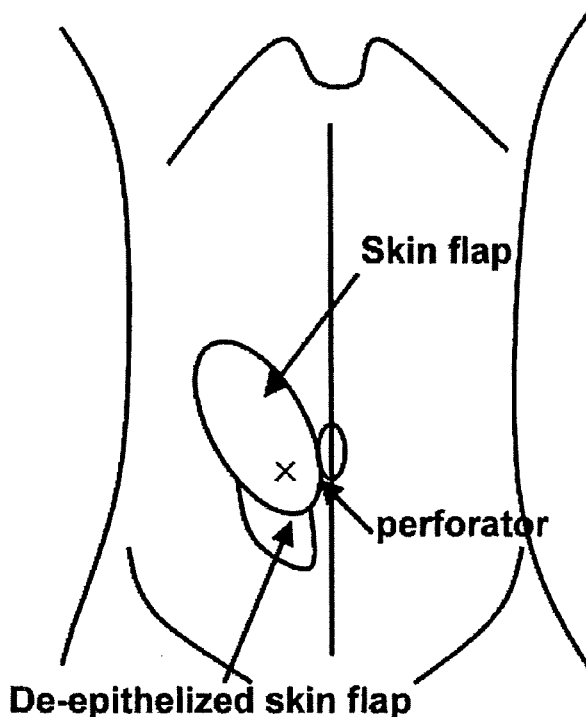


Figure 10. A flap design including a de-epithelialized skin flap. The flap was designed as two connecting skin islands: one as a skin paddle to resurface the oral defect and the other as a de-epithelialized skin flap to eliminate the dead space.

and Soeda⁴ have reported that with only a single stable perforator vessel, a skin island as large as 25×15 cm can be raised, and a skin flap can be raised as two connected island flaps. Our surgical plan was as follows. First, a DIEP free flap was elevated as two connected island flaps. Then, one of the skin islands was used to resurface the mucosal defect in the oral cavity, and the other island was de-epithelialized and used to obliterate the dead space (Fig. 10). A de-epithelialized skin flap substitutes for vascularized muscle as an obturator. With this flap design and setting, the dead space was eliminated, and the communication between the oral cavity and the neck was blocked. As a result, the quality of reconstruction was similar to that achieved with a musculocutaneous flap. In addition, abdominal muscle function can be preserved with minimal donor site morbidity. In fact, patient 2 successfully returned to work as a professional volleyball player without persistent abdominal muscle weakness.

The DIEP free flap has another advantage involving the donor site. This flap can be used for female patients, especially those of reproductive age. Several pregnancies have been reported after flap harvest from the abdomen. Collin and Coady⁵ conclude that normal deliveries following reconstruction with a transverse rectus abdominus

myocutaneous (TRAM) flap are relatively safe. However, major complications, such as abdominal bulging and hernia, are always a greater concern during pregnancy after TRAM flap reconstruction than after DIEP free flap reconstruction. In addition, Ong et al.⁶ have recommended the use of DIEP free flaps for female patients of reproductive age, because donor site morbidity is less. Furthermore, Popovtzer et al.⁷ have reported that tongue cancer has become more common in younger patients, especially those younger than 40 years. Therefore, reducing surgical stress to the donor site is especially advantageous for women of reproductive age, as were our patients.

Although the use of DIEP free flaps has advantages in terms of donor site morbidity, the resistance of de-epithelialized skin flaps to infections or orocutaneous fistulae is controversial. Muscle tissue may be beneficial for preventing infections,⁸ a notion supported by experienced surgeons, but there have been few reports about using de-epithelialized skin to control infection. For example, Ao et al.⁹ have reported the advantages of using a de-epithelialized ALT flap for head and neck reconstruction. They divide the flap into two separate flaps: one is used to cover the defect and the other is folded to achieve sufficient bulk for filling the dead space. With this technique, intraoral defects can be resurfaced, and dead space can be obliterated without complications. However, the potential of additional dead space forming in the kinks of the folded de-epithelialized skin flap has been noted. The creation of such dead space might be prevented by thinning the de-epithelialized skin flap, thereby making it more flexible and pliable.

At last, there is a possibility of fat hypertrophy of the transferred flap in the future, but this kind of complication was not observed by now in those two cases.

With this technique, a de-epithelialized skin flap might be used instead of a muscular flap for head and neck reconstruction.

CONCLUSION

We believe that head and neck reconstruction with a DIEP free flap is preferable when a patient has specific reasons for avoiding a RAMC flap, such as a wish to preserve abdominal wall functions and stability. However, a DIEP free flap cannot always be recommended for head and neck reconstruction, and it is still one of many options, because the reliability of de-epithelialized flaps for infection control is unclear.

REFERENCES

1. Blondeel PN. One hundred free DIEP flap breast reconstructions: A personal experience. *Br J Plast Surg* 1999;52:104-111