考　察

病期の進行した下咽頭癌や喉頭癌などの治療は，下咽頭・喉頭・頸部食道の全摘術（TPLE）が行われる場合が多い。TPLE後の全周性欠損に対して，過去には前腕皮弁やDP皮弁などの皮膚管による再建も広く行われていたが，瘻孔形成などの術後合併症の頻度が高いことが報告されるようになり[5]，現在は遊離空腸移植（FJT）による再建が第一選択で標準術式と考えられている。

当院では，1982年に1例目のTPLE＋FJTの手術が海老原・波利井によって行われたが，このときの手術時間は7時間20分，出血量は520ccであった。術後10日目にX線透視を行い，口側吻合部にわずかに造影剤の漏出を認めたが，術後17日目に経口摂取を開始している。その後20数年経過しているが果たして，標準化が達成出来ているかどうかは疑問の余地がある。杉山らによる多施設共同研究では全国764例を集積し，手術時間や，出血量，術後の経口開始日数，在院日数などで施設間の差が大きい事を報告している[6]。この事は，TPLE＋FJTが標準術式と認知されているものの，実際には手技的なばらつきが大きいことを意味している。症例数の多い施設のほうが，ラーニングカーブは上昇しやすいのは当然であるが，少ない症例数で良好な成績を上げている施設もあるため，この様な調査に基づいて，今後は全国的に標準化されることが望ましいと思われる。

手術手技を標準化することは，治療の画一化を招く可能性がある一方で，術後合併症を減らすという観点からは非常に有用であると考えている。当院では概ね統一した術式が成立し，標準化がなされたと考えられる前後でその治療成績を比較したところ，瘻孔形成や吻合部狭窄の頻度は標準化後に著明に減少していた。またこれに伴って術後の平均在院日数も31.7日から24.4日と著明に短縮しており，標準化による成績の向上がみとめられている[7]。一方，手術時間の有意な短縮は得られなかったが，これは近年放射線化学療法が初回治療で選択される場合も多く，手術の困難さが増加している事が要因の一つではないかと考えている。

最後に，今後は手術の安全性に対する社会の要求が徐々に高くなる上に，放射線化学療法後のサルベージ手術の増加が予想される。これらの困難に立ち向かい，良好な成績を収めるためには，クリニカルパスの導入や多施設間の共同研究などを通じて，頭頸部外科医と再建外科医が協力して治療にあたることが重要であると考えられる。

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Monitoring the Changes in Intraparenchymatous Venous Pressure to Ascertain Flap Viability

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Background: Disruption of venous outflow can lead to tissue necrosis. Thrombosis of a venous channel at the coaptation site in instances of free tissue transfer could cause death of the transplanted tissues. Although various techniques have been used to monitor the viability of transferred tissues, there has been no technique designed specifically to check the flow within and the patency of the venous channel. The authors have devised an approach with which to monitor the changes in venous pressure in a composite tissue transferred by means of microsurgical technique for bodily reconstruction.

Methods: The status of the venous system in various composite tissue grafts was monitored at the time of surgery or for 3 days after the completion of surgery by placing a small-caliber catheter in the vein within the transferred tissue. A total of 52 patients participated in the study.

Results: The venous pressure noted in grafts with a patent venous channel remained constant within a range between 0 and 35 mmHg. Venous insufficiency was detected in three of the 52 cases, with unmistakable findings of an elevated venous pressure of over 50 mmHg.

Conclusions: The technique of measuring the venous pressure by means of an indwelling venous catheter to monitor changes was found to accurately assess the patency of the venous channel and, by inference, the viability of the transferred tissue. No morbidity was associated with the technique. (*Plast. Reconstr. Surg.* 119: 2111, 2007.)

The success rate of free tissue transfer has been improved since its introduction more than three decades ago. Increasing experience among microsurgeons, the development of more reliable flaps, and improved microsurgical techniques and instruments have contributed to reduce the failure rate of free tissue transfer. Despite improved initial success rates of over 95 percent,[1–3] anastomotic failure may occur on either the arterial side or the venous side and remains a major cause of tissue loss. Because necrosis of a transferred tissue is a costly disaster and salvage of the affected tissue largely depends on the time to reexploration,[1,3] accurate assessment of flap circulation is essential.

Various methods have been described for assessing the adequacy of blood flow to a transplanted tissue. These include laser Doppler flowmetry,[2,4,5] color duplex sonography,[6,7] noninvasive ultrasound Doppler,[8] implantable Doppler,[9,10] hydrogen clearance,[11] pH measurement,[12] photoplethysmography,[13] transcutaneous oxygen tension,[14] and temperature.[15] An ideal monitoring method should be continuous, instantaneous, reliable, reproducible, and easily interpretable. Although the above methods have proven useful in judging the adequacy of the arterial blood flow, they have not specifically indicated blood flow disturbance in venous channels.

Veins are susceptible to trauma of various sorts because of their thin walls and fragile structures. It is well known that venous thrombosis is more common[1] and more harmful to a flap than arterial thrombosis.[16,17] Because the very first event that occurs after venous occlusion is an increase in venous pressure, monitoring this parameter may provide instantaneous information about venous insufficiency after free tissue transfer. Pressure changes within a venous channel can be monitored by placing a catheter inside the vein. We used this technique in 52 patients who un-

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derwent free flap transplantation between 1999 and 2004 to determine the usefulness of venous pressure measurement and monitoring as a method for ascertaining venous channel patency. The experience gained from this group of patients formed the basis of this report.

PATIENTS AND METHODS

Between 1999 and 2004, a total of 52 patients underwent free tissue transfer with monitoring of the intraparenchymatous venous pressure. There were 19 female patients and 33 male patients. Patient ages ranged from 17 to 76 years, with a mean age of 54 years. Initially, we used this method for patients who developed venous thrombosis postoperatively, and the catheter was inserted during the reoperation, with the intent of salvaging the transferred tissue. Recognition of the versatility and safety of venous catheterization subsequently led us to expand the indication to primary cases with free tissue transfer, especially those considered to be at high risk of venous thrombosis. The criteria for indication of in situ venous catheterization included heavy smoking, tissue with irradiation sequelae, reconstruction of traumatized lower extremities, buried flap, bony reconstruction, intraoperative vascular thrombosis, and usage of long-vein grafting for venous anastomosis (Table 1). The specific donor sites used and their distribution among the recipient sites are listed in Tables 2 and 3.

Description of Indwelling Venous Catheter Placement

The patients were fully informed concerning the reasons, the technique of catheter placement, the details of the monitoring procedure, and the consequences and possible complications associated with catheter placement. The possible problems included bleeding, hematoma formation, and persistent pain.

After completion of vascular anastomoses, an intravenous catheter (3 French, 1.0-mm outside diameter; Atom Medical Co., Tokyo, Japan) was inserted into a side branch of the anastomosed vein. The more peripheral side branch was preferable, provided that the catheter could be inserted. In the case of a radial forearm flap or a fibular osteocutaneous flap, the catheter was inserted by means of the distal end of a comitant vein of the radial or fibular artery.

Table 1. Indications for Monitoring the Intraparenchymatous Venous Pressure

Indication	No. of Occurrences (%)
Reexploration for venous thrombosis	8 (15.4)
Intraoperative thrombosis	7 (13.5)
Traumatized lower extremity	14 (26.9)
Buried flap	9 (17.3)
Bony reconstruction	5 (9.6)
Vein grafting	5 (9.6)
Postirradiation therapy	7 (13.5)
Heavy smoking	8 (15.4)

Table 2. Types of Transferred Tissue

Flap Type	No. of Patients
Rectus abdominis	12
Radial forearm	8
Anterolateral thigh	7
Groin	6
Fibula	5
Latissimus dorsi	4
Jejunum	3
Deep inferior epigastric perforator	3
Omentum	2
Saphenous	1
Fillet	1
Total	52

ALT, anterolateral thigh; DIEP, deep inferior epigastric perforator.

Table 3. Flap Destination

Flap Location	No. of Patients
Head and neck	20
Trunk	14
Upper extremity	4
Lower extremity	14
Total	52

Pressure Measurement

The venous catheter was connected to a fluid pressure transducer (P23ID; Statham Gould, Oxnard, Calif.) and to a physiologic recorder (BSS-9800; Nihon Kohden Co., Tokyo, Japan). Zero calibrations were taken at the level of the right atrium. To ascertain the functional integrity of the monitoring system, the venous outflow was occluded manually at a site proximal to the coaptation site once the catheter was in place (Fig. 1).

The venous pressure monitoring was performed in conjunction with local delivery of an anticoagulant agent using a flushing device. The line solution of the venous catheter contained heparin (10 units/ml) in 0.9% sodium chloride, and the flow rate of the flush solution was approximately 3 ml/hour,[18] resulting in continuous infusion of the heparin at 720 units/day. Three days after surgery, the catheter was locked and disconnected from the transducer but left in position for a further 4 days. Thereafter, the catheter was

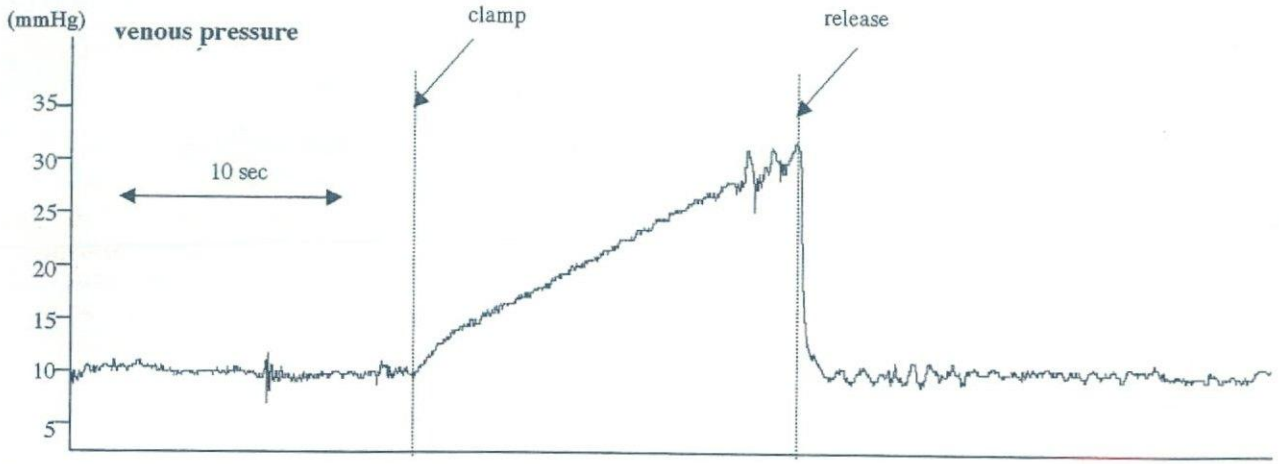

Fig. 1. Transient clamping of an anastomosed vein gradually increased the venous pressure. Release of the venous clamp led to an immediate drop in the venous pressure to the baseline level.

gently tugged at and withdrawn from the flap. No bleeding occurred.

Laser Doppler Flowmetry

In addition, the blood flow was continuously monitored in 23 of the patients using a laser Doppler flowmeter (Laserflo BPM 403; TSI, Inc., St. Paul, Minn.) with a standard right-angle probe with a head diameter of 19 mm (model P-430). This apparatus measures a Doppler shift in reflected laser light, which is related to the number and velocity of moving red blood cells, providing flow values in milliliters per minute per 100 g of tissue. Inherently, this method could not be applied to cases of a buried flap or mucosal reconstruction, unless the grafted tissue was partially exteriorized.

Data Acquisition

Both the venous pressure and surface blood flow were continuously recorded with a computerized data acquisition system (PowerLab; AD Instruments Pty. Ltd., Australia) for later analysis. The recording of the parameters was continued for 3 days, and the mean values for each 24-hour period were analyzed with the software. The alarm for an elevated venous pressure was set at 50 mmHg using the physiologic recorder. Because the parameters were automatically recorded, the nurses did not need to record the venous pressure or the flow values manually. They were instructed to check the monitoring devices and flap color, in cases with a cutaneous component, every 2 hours for 3 days.

The values for the venous pressure and laser Doppler flowmetry on each postoperative day are reported as means ± SD. Statistical evaluation was performed using analysis of variance with repeated measures across time. A value of $p < 0.05$ was considered statistically significant.

RESULTS

Of the 52 flaps, two developed venous thrombosis intraoperatively, and another case developed venous thrombosis 15 hours after surgery. In these three cases, venous insufficiency was detected easily on the basis of an elevated venous pressure of over 50 mmHg, and reanastomosis of the vein led to complete survival of the transferred tissue. There were no cases of free flap loss.

The normal pressure range in uncomplicated free tissue transplants was established by analyzing the data. Among the multiple tissue types and recipient sites, the venous pressure value was relatively constant within the range of 0 to 35 mmHg. The venous pressure during the first postoperative day was 17.5 ± 8.8 mmHg (Fig. 2). The venous pressure tended to decline on days 2 and 3, although it did not reach statistical significance (Fig. 2). The flow rate with laser Doppler flowmetry varied from 0.8 to 13.1 ml/minute/100 g tissue. The flow rate during the first postoperative day was 3.75 ± 1.97 ml/minute/100 g. The flow rate was virtually unchanged during the next 2 postoperative days (Fig. 3).

CASE REPORT

A 55-year-old woman presented with intraosseous carcinoma arising from an impacted third molar. A fibular osteocutaneous flap was used to reconstruct the bony and soft-tissue defect that resulted from segmental mandibulectomy with concomitant radical neck dissection (Fig. 4). Because the cutaneous flap was

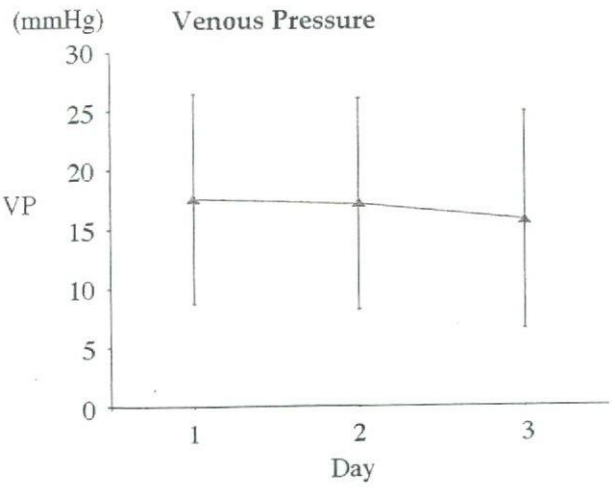

Fig. 2. Changes in intraparenchymatous venous pressure after free tissue transfer. Values are given as means ± SD (n = 51).

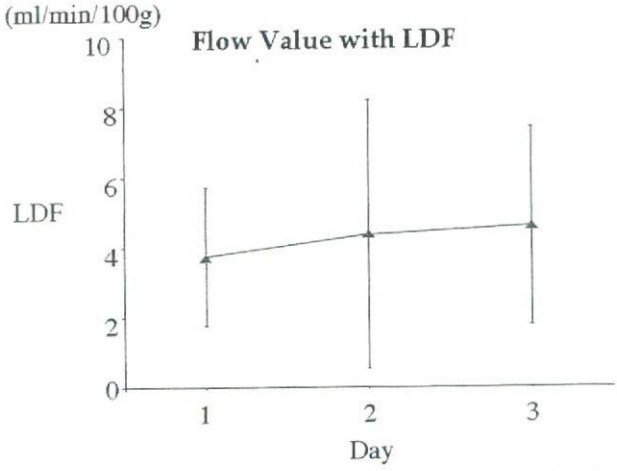

Fig. 3. Changes in surface blood flow as represented by flow value with laser Doppler flowmetry (*LDF*; in milliliters per minute per 100 g) after free tissue transfer. Values are given as mean ± SD (n = 23).

located in the oral cavity, laser Doppler flowmetry was not applicable. Therefore, we inserted a catheter into the distal end of the peroneal artery and the comitant vein (Fig. 4). Although the venous pressure was found to be stationary at approximately 25 mmHg for the first 15 hours after surgery, it began to rise incrementally over the next 2 to 3 hours (Fig. 5). We decided to reexplore the wound at 18 hours after surgery because of venous hypertension, even though the color of the flap was judged to be normal. A thrombotic occlusion at the venous coaptation site was found during reexploration of the wound (Fig. 6).

During the reoperation, venous pressure was monitored continuously using the catheter, which was also useful for flushing the vessel in an attempt to remove the clot from inside the vasculature. The venous hypertension disappeared after the clot was removed from the lumen. The continuity of the venous channel was reestablished by using a vein graft. The patient showed no further signs of venous flow impediment, and recovery from the procedure was uneventful (Fig. 7).

DISCUSSION

Early surgical intervention to eliminate any blood flow impediment is the key factor in "rescuing" an ailing flap.[1] Clinical indications for wound reexploration, however, are difficult to define. Over the years, many methods have been advocated for monitoring the blood flow in a transplanted flap.[3–15] However, the information obtained with those various monitoring techniques is rarely helpful to surgeons in determining the need for reexploration of the operative site, especially if a venous outflow disturbance is involved. It is essential, in this regard, for surgeons to have a monitoring technique that is simple and yields information that clearly defines the indication for wound reexploration.

Of the various modalities advocated for postoperative monitoring of flap circulation, the laser Doppler flowmetry technique was thought to be the most useful for assessing interstitial blood flow. It is noninvasive and designed to monitor capillary perfusion. Although this method can deliver objective data, the flow values vary greatly depending on the patient, type of tissue, equipment, type of probe, and recipient site.[2,4,19] Therefore, one must not rely on absolute values, and current reports emphasize the importance of observing the trend of the perfusion value rather than the absolute value.[2,4] This is particularly important in the case of venous occlusions, for which experimental studies have shown that the drop in flow values is not as abrupt and steep as in the case of arterial obstructions.[20] In the clinical setting, Mailaender et al.[19] demonstrated the difficulties in diagnosing venous thrombosis by means of laser Doppler flowmetry caused by nonspecific alterations in the laser Doppler flowmetry signals. In addition, difficulty in placing the monitoring probe in certain parts of the body, as in our patient with intraoral structure reconstruction, can render the use of this technique impossible.

It is well known that venous congestion is more common[1] and more harmful[16,17] than arterial insufficiency. Considering the difficulty in early detection of venous thrombosis with previous monitoring methods, it makes sense to focus on venous thrombosis, attempting to reduce the failure rate of free tissue transfer. Hudson et al.[21] reported the use of a catheter inserted into a side branch of the vein in the transferred tissue. Through this catheter, heparin (500 units/hour) was infused effectively to the venous anastomotic site.[21] However, we believed that the infusion rate for catheter heparinization (30 units/hour) was sufficient to

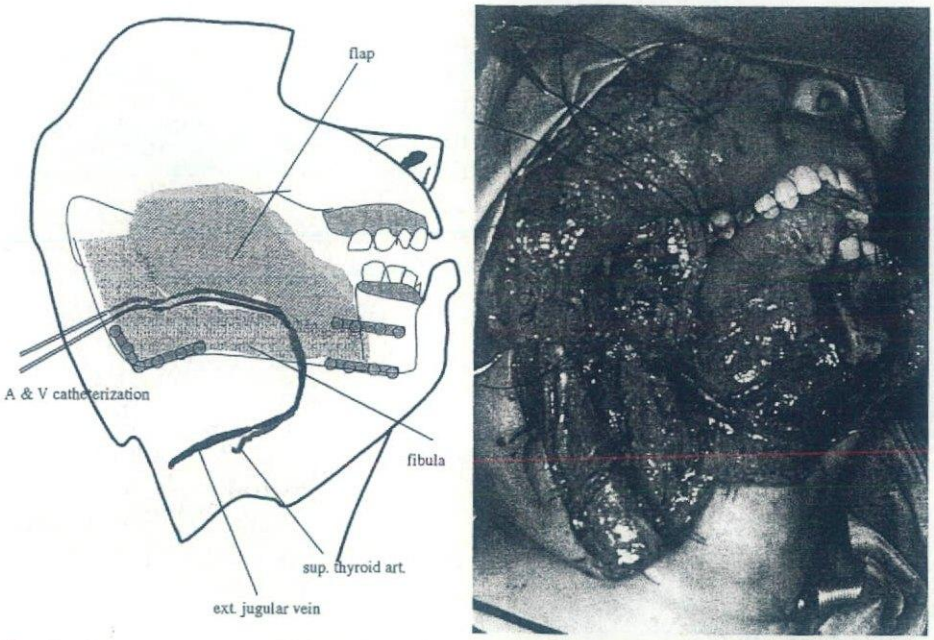

Fig. 4. Free osteocutaneous fibular flap with intraparenchymatous arterial and venous pressure monitoring.

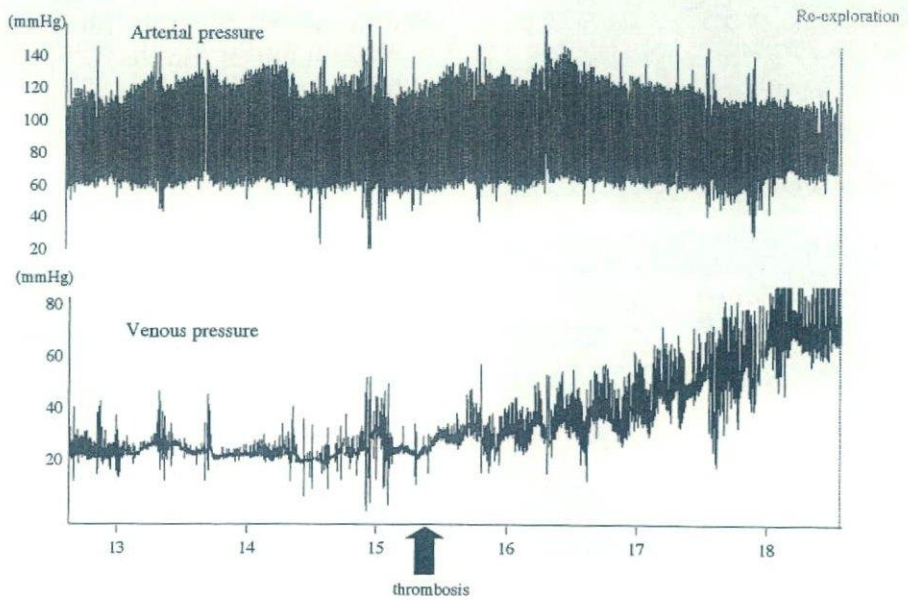

Fig. 5. Changes in intraparenchymatous arterial and venous pressures after venous thrombosis.

reduce coagulability at the local anastomotic site, because the blood flow perfusing the transferred tissue was less than 5 ml/minute in most cases (data not presented). Moreover, we considered that this catheter could be used as a sensitive monitoring device to detect venous thrombosis after free tissue transfer.

In contrast to laser Doppler flowmetry, venous pressure monitoring was able to provide us with instantaneous evidence of venous occlusion. In all three flaps that sustained venous occlusion, the venous pressure elevated to over 50 mmHg before any clinical signs became obvious. The absolute values for venous pressure were easily interpretable even by the nursing staff and inexperienced residents. In addition, continuous monitoring of venous pressure allowed us to identify the onset time of venous pressure elevation, as noted in the described case.

Fig. 6. Venous thrombosis detected during the reoperation.

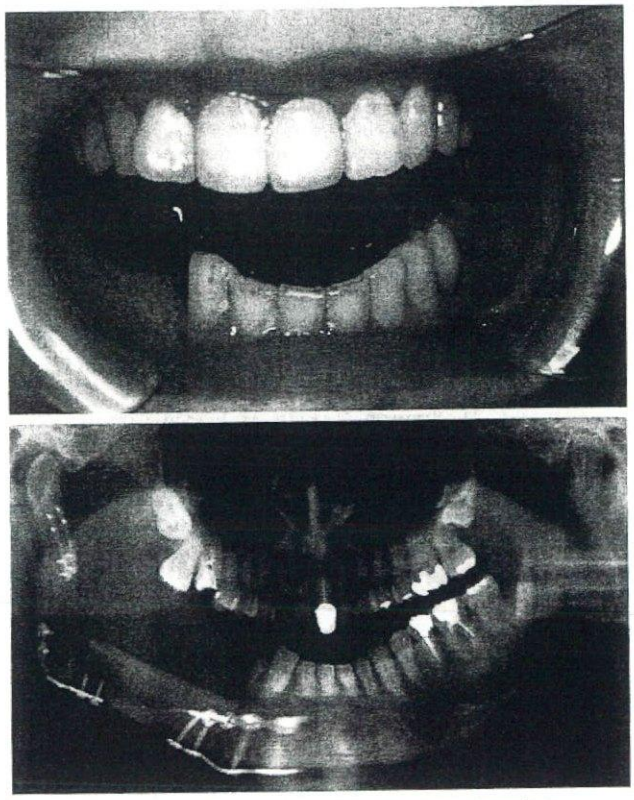

Fig. 7. Six months after reoperation. The transferred tissue survived completely.

The ability to detect problems intraoperatively is considered to decrease the incidence of reexploration after free tissue transfer.[9] Intraoperative monitoring of venous pressure rapidly detected venous insufficiency found in two of our present 52 cases, and also in other cases where we have noticed transiently elevated venous pressure as the wound was closed or a dressing was applied, which was then corrected immediately. In addition, this monitoring modality helped to facilitate postoperative care by avoiding critical elevations in venous pressure because of posturing and movement by the patient. Because the blood flow is derived from the pressure gradient between the arterial and venous sides, keeping the venous pressure at a lower level is important to ensure good perfusion in the transferred tissue. Despite the high-risk group indicated for venous pressure monitoring in our patient series, postoperative venous thrombosis occurred in only one of the 52 patients. The ability to detect critical venous pressure elevation during the intraoperative and/or postoperative period might lead to a lower incidence of venous thrombosis.

Reproducibility on an individual basis may be affected by potential artifacts, such as an unfavorable location of the catheter, motion, posturing, and obstruction of the line connected to the transducer. However, provided that one has a clear understanding of the technical background of this method, intraparenchymatous venous pressure monitoring can provide reproducible results in the assessment of venous compromise. This technique is not advocated for all cases of free-flap surgery because of potential complications in association with the pulling out of the catheter. Because we experienced only one case of postoperative venous thrombosis, further investigations were obviously required to discuss cost-effectiveness analysis of this technique. It would seem to be particularly indicated for high-risk patients, such as those demonstrated to have an abnormality in the venous anatomy, those undergoing reconstruction after lower leg trauma, and those requiring a vein graft.

CONCLUSIONS

Venous outflow abnormalities in instances of free composite tissue graft transfer can lead to devastating sequelae. Although various methods for monitoring the interstitial blood flow have been advocated, no single approach has been found to provide reliable information about incompetence of venous outflow. Monitoring the changes in the venous pressure is a method that is simple to implement, and the findings are, generally speaking, reliable and useful in helping the surgeon to decide when to reexplore the operative site. Although the venous pressure is in the range of 0 to 35 mmHg during the first 3 days after surgery, a subsequent trend to venous hypertension reaching a level of 50 mmHg clearly indicates venous outflow obstruction. Reexploration of the

wound is indicated if the "ailing" flap is to be rescued.

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DISCLOSURE

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this article.

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HEMODYNAMIC ALTERATIONS IN THE TRANSFERRED TISSUE TO LOWER EXTREMITIES

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A higher incidence of failure has been reported for free flaps transplanted to the lower extremities. However, the physiological background of this phenomenon has not been elucidated. We reviewed the 3-day postoperative hemodynamic data for 103 free flaps, including the in situ venous pressure (N = 103), arterial pressure (N = 53), and surface blood flow (N = 42). The cases were divided into two groups based on the recipient site, i.e., lower extremity (the LE group: N = 29) and the other (non-LE group: N = 74). The venous pressure was significantly higher in the LE group (26.6 ± 2.2 vs. 14.8 ± 1.2 mmHg), whereas the arterial pressure immediately after surgery was lower than the non-LE group. The hemodynamic data within the transferred tissues demonstrated significant differences between groups, especially in the early postoperative period. There is a possibility that the high venous pressure may aggravate the poor perfusion in tissues transferred to the lower extremities. © 2008 Wiley-Liss, Inc. Microsurgery 29:101–106, 2009.

Lower extremity reconstruction has enjoyed renewed interest with the development of free tissue transfers.[1–3] However, thrombosis and flap failure remain major complications of this method. Despite improved overall success rates approaching 99% in several retrospective analyses of free flaps,[4–6] transfers to the lower extremities still show failure rates of more than 10%, especially under posttraumatic conditions.[2,7,8] Although a multitude of factors determine the success or failure of a microvascular free tissue transfer,[9] the actual reason for the higher risk of flap failure in lower extremity reconstruction has not been elucidated. Infection has been suggested as a predominant cause of morbidity in free flaps transferred to the lower legs.[10] However, other factors must be considered in the majority of cases of failure in which aggressive wound care and antisepsis were properly undertaken. Hypercoagulability associated with thrombocytosis may be related to the higher incidence of vascular thrombosis in lower leg reconstructions,[11] although this scenario also is applicable only to limited cases in limited situations.

The vascular system in the legs is unique because it has a high hydrostatic pressure during orthostasis,[12,13] and it is easily affected by several disorders on both the arterial and venous sides. We hypothesized that tissues transferred to the lower extremities may present different hemodynamics compared with other parts of the body in the early postoperative period. Currently, we have developed a novel method for monitoring the flap circulation with regard to the intraparenchymatous vascular pressure.[14] This study is based upon data collected in patients who underwent microvascular free tissue transfer with this novel monitoring system. The patient profiles such as sex, etiology, and preferred tissue for reconstruction and recipient vessels were totally different among patient groups. In spite of these inherent differences, we decided that it would be informative to determine the hemodynamic characteristics in tissues transferred to different recipient sites.

PATIENTS AND METHODS

Patients

This study included 103 consecutive patients who underwent free tissue transfer with venous pressure monitoring between 2003 and 2007. This monitoring system, approved by the ethical committee of Tokyo Women's Medical University, included a continuous data acquisition system,[14] therefore, we retrospectively reviewed hemodynamic data in the transferred flap. The patients with a history of cardiopulmonary disorder or hypertension were excluded in the study. All patients underwent surgery under general anesthesia. There were 38 female and 65 male patients. The patients ranged in age from 9 to 82 years, with a mean age of 54 years. The patients were divided into two groups depending on the recipient site, lower extremity (LE group; N = 29), and other sites (non-LE group; N = 74). The specific donor sites employed in the two groups are shown in the Table 1. In the LE group, we preferentially used the deep venous system rather than the superficial venous system as the recipient vein (Table 2). We included four cases of stasis ulcer because of superficial venous insufficiency, for which superficial venous stripping was performed prior to the free tissue transfer.

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Venous Pressure Measurements

The patients were fully informed concerning the reasons, the technique of catheter placement, the details of the monitoring procedure, and the consequences as well as possible complications associated with catheter placement.

After completion of vascular anastomoses, an intravenous catheter (3 Fr, 1.0-mm OD, Atom Medical, Tokyo, Japan) was inserted into a side branch of the anastomosed vein. The catheter was then connected to a fluid pressure transducer (P23ID, Statham Gould, Oxnard, CA) and to a physiological recorder (BSS-9800, Nihon Kohden, Tokyo, Japan). The line solution of the venous catheter contained heparin at 10 U/ml in 0.9% sodium chloride, and the flow rate of the flush solution was ~3 ml/hr, resulting in continuous infusion of the heparin at 720 U/day. Zero calibrations were taken at the level of the right atrium.

Three days after the operation, the catheter was locked and disconnected from the transducer, but left in position for a further 4 days. Thereafter, the catheter was gently tugged at and withdrawn from the flap.

Table 1. Patient Profiles: Gender, Age, and Donor Site

	LE group (N = 29)	Non-LE group (N = 74)
Male/female	24/5	41/33
Age (year)	49 ± 4	52 ± 2
Type of tissues		
Anterolateral thigh flap	15	16
Groin flap	5	9
LD musculocutaneous flap	3	11
Omentum	2	
Fibula osteocutaneous flap	2	4
Rectus abdominis MC flap		12
Jejunum		7
Forearm flap		6
DIEP flap		3
DP		3
Others	2	3

Table 2. Patient Profiles of the LE Group

					Recipient vessel		Measurement			
No.	Sex	Age	Ethiology	Flap	Artery	Vein	VP	AP	LDP	Comment
1	M	29	Tibial bone open fracture	FOCF	PTA	PTV	+			
2	M	64	Intractable ulcer on the lower leg	ALT	ATA	ATV	+			
3	M	74	Intractable ulcer on the lower leg	Omentum	ATA	ATV	+	+		
4	M	71	Tibial bone open fracture	FOCF	ATA	ATV	+			
5	M	35	Traumatized lower leg	ALT	ATA	ATV	+	+		Arterial thrombosis
6	M	59	Intractable stasis ulcer on the lower leg	Omentum	ATA	ATV	+	+		
7	M	17	Scar contracture of the dorsal foot	Groin flap	DPA	GSV	+			
8	M	68	Chronic osteomyelitis of tibial bone	ALT	ATA	ATV	+	+	+	
9	M	71	MM at the heel	ALT	PTA	PTV	+		+	
10	M	46	Intractable stasis ulcer on the lower leg	ALT	PTA	PTV	+		+	
11	M	43	SCAR contracture around knee joint	Groin flap	DGA	GSV, DGV	+	+	+	
12	M	80	SCC at the medial foot	ALT	PTA	PTV	+	+	+	
13	F	63	Intractable stasis ulcer on the lower leg	ALT	PTA	PTV	+	+	+	
14	M	55	Chronic osteomyelitis of the femur	ALT	DGA	GSV	+	+	+	
15	M	9	Degloving injury of the foot	LD	ATA	ATV	+	+	+	
16	M	28	Mangled lower extremity	Fillet flap	FA	FV	+			
17	M	33	Intractable ulcer on the foot	ALT	ATA	ATV	+	+		Hematoma
18	F	64	Intractable ulcer on the lower leg	LD	ATA	ATV	+			
19	F	13	Postburn contracture on the thigh	Groin flap	SIEA	GSV	+		+	
20	M	68	SCC on the lower leg	ALT	ATA	ATV	+	+	+	
21	F	58	AVM on the foot	Groin flap	LTA	SSV	+	+	+	
22	M	49	Postburn contracture on the lower leg	Scapular flap	DGA	SSV	+		+	
23	M	49	Diabetic ganglene	ALT	ATA	ATV	+	+		
24	M	59	Intractable ulcer on the lower leg	LD	FA	ATV	+	+		
25	M	64	Traumatized foot	Groin flap	DPA	GSV	+	+	+	
26	M	20	Traumatized foot	ALT	PTA	PTV	+	+	+	
27	F	68	Intractable stasis ulcer on the lower leg	ALT	PTA	PTV	+	+	+	Venous thrombosis
28	M	48	Intractable ulcer on the foot	ALT	ATA	ATV	+	+	+	
29	M	17	Intractable ulcer on the foot	ALT	PTA	PTV	+	+	+	

M, male; F, female; FOCF, fibula osteocutaneous flap; ALT, anterolateral thigh flap; LD, latissimus dorsi MC flap; PTA (V), posterior tibial artery (vein); ATA (V), anterior tibial artery (vein); DPA, dorsalis pedis artery; DGA(V), descending genicular artery (vein); LTA, lateral tarsal artery; GSV, great saphenous vein; SSV, small saphenous vein.

Arterial Pressure Monitoring

Fifty-three of the patients (LE group: 19, non-LE group: 34) also underwent in situ arterial catheterization for further hemodynamic analysis. The method was essentially the same as that for the venous catheterization. However, the line solution of the arterial catheter did not contain heparin, avoiding the risk of bleeding tendency in the transferred tissue. In some case, the arterial catheterization was impossible because of the small size of the diameter. In those cases, we used Doppler auscultation for the monitoring of arterial thrombosis.

Laser Doppler Flowmetry

In addition, the surface blood flow was continuously monitored in 42 patients (LE group: 17, non-LE group: 25) using a laser Doppler flowmeter (Laserflo BPM 403, TSI, St. Paul, MN) with a standard right angle probe having a head diameter of 19 mm (Model P-430). This probe is applicable only to the exteriorized skin island. This apparatus provided flow rates in millimeters per minute per 100 g of tissue.

Data Acquisition

All parameters were continuously recorded for 3 days at a sampling frequency of 250 Hz via a commercial data acquisition system (PowerLab®, AD Instruments Pty., Australia). During this postoperative period, all patients were confined to bed rest. Because all parameters were influenced by the patient's positioning, posture, and movements, analysis was performed of sections showing stable hemodynamics for more than 30 minutes while the patients were at rest and in the supine position (immediately after surgery and 12 and 72 hours after surgery). The mean values of the venous pressure, arterial pressure, and blood flow were obtained using the customized program included in the data acquisition system (PowerLab).

Data Analysis and Statistics

Data are expressed as means ± SEM. The effects of different recipient sites (i.e., LE, non-LE groups) on the hemodynamic data were tested using ANOVA with repeated measures across time. Statistical significance was defined as a P value of 0.05 or less. All statistical analyses were performed with SAS statistical package version 8.2.

RESULTS

There were three cases with postoperative anastomotic failure (two cases of venous thrombosis and one case of arterial thrombosis) in the 103 cases. One of the cases with venous thrombosis received a mandibular reconstruction with free fibular osteocutaneous flap (in the non-LE group). In this case, cutaneous flap was located in the oral cavity, therefore, the flow probe of the LDF was not readily applicable. The other case who developed venous thrombosis presented with an intractable stasis ulcer. In this case, we applied both venous pressure monitoring and LDF monitoring. Both methods were quite sensitive responding the compromised venous outflow. The arterial thrombosis in another case was detected with the continuous arterial pressure monitoring. All three cases were successfully salvaged by the early detection with the monitoring system. There was no statistically significant difference in the incidence of the vascular thrombosis between two groups.

Free flaps transplanted to the lower extremities demonstrated a significantly higher venous pressure compared with the other sites (LE: 26.6 ± 2.2 mmHg, non-LE: 14.8 ± 1.2 mmHg) (see Fig. 1). The high venous pressure in the LE group declined gradually, whereas the venous pressure in the non-LE group remained virtually unchanged during the 3-day postoperative period.

The arterial pressure in the LE group was significantly lower than that in the non-LE group (see Fig. 2). Therefore, the arteriovenous pressure gradients, defined as the driving pressure for perfusion of transferred tissues, showed significant differences between groups (see Fig. 3). The driving pressure in the LE group was 52.6 ± 3.7 mmHg immediately after surgery, whereas those in the non-LE group was 75.0 ± 2.4 mmHg. Thereafter, the lower driving pressure in the LE group gradually increased to 59.8 ± 3.6 mmHg at 72 hours after surgery; however, it was still significantly lower than the non-LE group.

The surface blood flow measured by the laser Doppler flowmeter in the LE group was 2.2 ± 0.6 ml/min/100 g immediately after surgery, whereas that in the non-LE group was 3.7 ± 0.5 ml/min/100 g (see Fig. 4). There was no statistically significant difference between groups. As the driving pressure increased during the 3-day postoperative period, the blood flow increased significantly in the LE group (4.1 ± 0.9 ml/min/100 g on the 3rd postoperative day). On the other hand, the blood flow in the non-LE group was relatively constant during the 3-day postoperative period.

DISCUSSION

Free tissue transfer using a microvascular technique has been firmly established since its introduction more than three decades ago. However, little is known about the physiological aspects within the transferred tissue. The monitoring technique currently developed in our institution,[14] in which the in situ vascular pressure can be continuously measured, provides us a great opportunity to elucidate the hemodynamic changes after free tissue transfer. Although this method required catheterization of

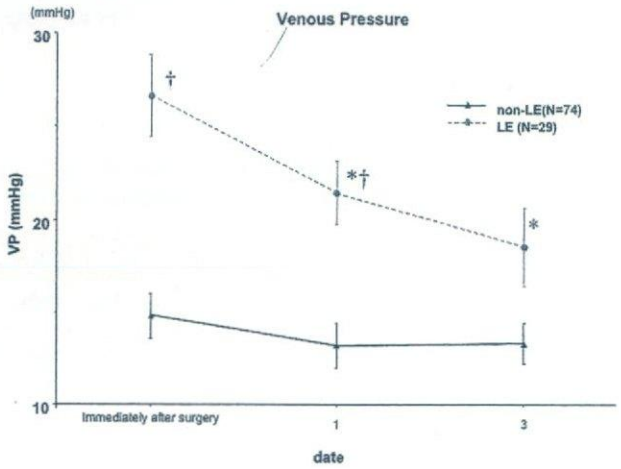

Figure 1. Changes in venous pressure within the tissues transferred to the lower extremity (LE group) and the other sites (non-LE group). Values are given as the mean ± SEM. *: Significant difference ($P < 0.05$) from the value immediately after surgery. †: Significant difference ($P < 0.05$) between groups.

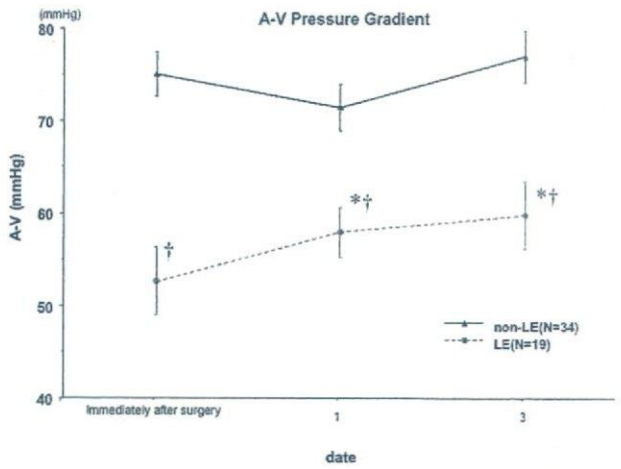

Figure 3. Changes in arteriovenous pressure gradient within the tissues transferred to the lower extremity (LE group) and the other sites (non-LE group). Values are given as the mean ± SEM. *: Significant difference ($P < 0.05$) from the value immediately after surgery. †: Significant difference ($P < 0.05$) between groups.

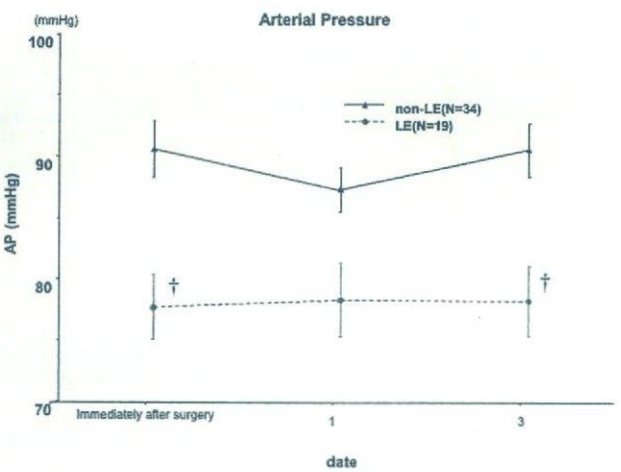

Figure 2. Changes in arterial pressure within the tissues transferred to the lower extremity (LE group) and the other sites (non-LE group). Values are given as the mean ± SEM. †: Significant difference ($P < 0.05$) between groups.

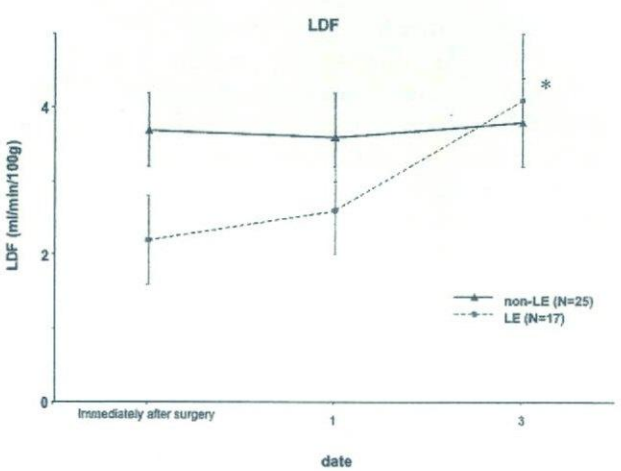

Figure 4. Changes in the value of LDF after free tissue transfer. Values are given as the mean ± SEM. *Significant difference ($P < 0.05$) from the value immediately after surgery.

the vessels within the transferred flap, the safety and efficacy of such catheterization has been well documented in previous reports in which anticoagulant agents were continuously infused through a catheter.[15–17]

In this study, the hemodynamic data within the transferred tissue were strongly influenced by the recipient site. The venous pressure in the LE group was significantly higher compared with the values in the non-LE group. It is conceivable that the positioning of the lower extremities may affect the venous pressure. Because we analyzed the venous pressure during the initial 3 days after surgery while the patients rested in bed the whole day, the gravitational effects on the venous pressure were considered to be at a minimum. Additionally, the site of the arterial catheterization was identical to the venous catheterization; therefore, the effect of the position of the recipient sites on the hemodynamic data was negligible when one looked at the pressure gradient between the arterial and venous sides. Because the arterial pressure in the LE group was significantly lower than that in the non-LE group, the arteriovenous pressure gradient showed clear differences between the groups. According to the concept of Burton,[18] a decreased driving pressure results in reduced blood flow. Although we could not detect significant difference in the incidence of anastomotic failure between the two groups, there is a possibil-

ity that the hemodynamic differences might be related to the reported high failure rates in lower leg reconstruction using free-tissue transfer.[2,7,8]

Lower limb hemodynamic impairment associated with surgery and general anesthesia has been well documented. Foate et al.[19] reported that the mean arterial leg blood flow in patients under general anesthesia was only 28% of the control at 1 hour after surgery. This compromised arterial inflow has been linked to a higher rate of early postoperative graft failure in infrainguinal arterial bypass surgery, whereas epidural anesthesia did not cause this adverse effect of general anesthesia.[20] Knaggs et al.[21] reported that the maximal venous flow attenuation was seen during the early recovery period. By disrupting the laminar flow of the venous circulation, stasis brings platelets into contact with the endothelium, leads to the build-up of thrombi and promotes the activation of endothelial cells, setting off a vicious circle of hypercoagulability. Although the mechanisms involved in the susceptibility of the lower leg hemodynamics to general anesthesia and surgical interventions are not fully understood, the early postoperative period is the most critical for vascular compromise even after free tissue transfer.

Despite the lower driving pressure in the LE group, we could not detect significant differences in the LDF data. This inability to detect differences may be attributed to the method we used for assessment of the blood flow. It is well known that the flow values with LDF vary greatly depending on the patient and the type of tissue.[22–24] Therefore, one must not rely on absolute values, and recent reports emphasize the importance of observing the trend of the perfusion rather than the absolute value.[22,23] It is of interest that the decrease in the venous pressure during a 3-day postoperative period was associated with an increased blood flow in the LE group.

When the venous pressure in a limb is elevated to more than 25 mmHg, the cutaneous, subcutaneous, and muscle vascular resistances increase within that region, resulting in a reduction in blood flow of about 40%.[13] This reflex has been termed the venoarteriolar response, because stretch receptors located in small veins induce changes in the arteriolar vascular tone "upstream" of the veins.[12] A local mechanism, not the central neurogenic response, seems to mediate the venoarteriolar response. Therefore, the high venous pressure may aggravate the poor perfusion in the transferred tissue through this response, leading to the high incidence of failure in lower limb reconstruction.

This study is limited by its small number of patients. Further investigations are warranted to determine the effects of injury-related variables, the type of transferred tissue, the selection of the recipient vessels, local heparinization, and epidural anesthesia. Nonetheless, monitoring the vascular pressure through in situ catheterization provided us further insight into the pathophysiology after free tissue transfer.

CONCLUSIONS

In summary, tissues transferred to the lower extremities demonstrated a higher venous pressure and poorer perfusion immediately after surgery compared with tissues transferred to other parts of the body. Thereafter, the venous pressure gradually decreased in association with an increase in the blood perfusion of the flap. There is a possibility that the impaired hemodynamics in tissues transferred to the lower extremities might be a contributing factor to the higher incidence of flap failure during the early postoperative period.

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＜原　著＞

乳癌術後乳房再建術に関するアンケート調査

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Results of Questionnaire Survey on the Actual Medical Status of Breast Reconstruction

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和文要旨

乳癌術後の乳房再建は，ようやく一般的にも認知されるようになってきた。2006年4月から乳房再建術が保険適用となり，今後ますます増加傾向を示すものと思われる。しかし，乳房再建においてもさまざまな問題点が山積しており，今後の動向を探るうえでも現状を把握することが重要と思われる。そこで，乳癌術後乳房再建の現状を把握し，数量化することによりその特色と課題を知り，今後の方向性に資することを目的として形成外科医を対象としたアンケートによる実態調査を実施した。対象は，全国の日本形成外科学会認定施設および教育関連施設（322施設）とし，アンケート項目は，病院のプロフィール，乳癌治療の診療実態，乳房再建の診療実態，一期的乳房再建の診療実態，二期的乳房再建の診療実態，今後の乳房再建のあり方に関する内容とした。回答は322施設中212施設より得られ，回収率は65.8％であった。その調査結果を報告するとともに，乳癌術後乳房再建の問題点と今後の展望につき報告する。

Key Words：乳癌，乳房再建，アンケート調査，形成外科，乳腺外科

英文アブストラクト

Breast reconstruction after mastectomy has finally been recognized generally. However, various issues regarding breast reconstruction have accumulated, and therefore, it seems important to clarify the present medical status when exploring a future trend. Accordingly, a questionnaire survey for plastic surgeons was carried out as a contribution to clarifying future directions because future tasks will become clearer by understanding and quantifying the present status of breast reconstruction. The questionnaires were distributed to all certified facilities and teaching institutions involved in plastic and reconstructive surgery (322 facilities) throughout Japan. The questionnaire items focused on the status or profile of a hospital, actual experience with breast carcinoma treatment, actual experience with breast reconstruction, actual experience with immediate breast reconstruction, actual experience with secondary breast reconstruction, and future breast reconstruction. Responses to this questionnaire survey were received from 212 of 322 institutions; i.e., the reply rate was 65.8%. In this article, we present survey results as well as an overview of current problems and future prospects in the field of breast reconstruction after mastectomy.

Key Words：breast cancer, breast reconstruction, questionnaire survey, plastic and reconstructive surgery, breast surgery

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はじめに

乳癌術後の乳房再建がわが国でも施行されるようになって20年以上が経過し，ようやく一般的にも認知されるようになってきた。そして，2006年4月から乳房再建術（乳房切除後一期的に行うもの，乳房切除後二期的に行うもの）が保険適用となり，今後ますます増加傾向を示すものと思われる。しかし，乳房再建においてもさまざまな問題点が山積しており，今後の動向を探るうえでも現状を把握することが重要と思われる。そこで，乳癌術後乳房再建の現状を把握し，数量化することによりその特色と課題を知り，今後の方向性に資することを目的として，形成外科医と乳腺外科医を対象としたアンケートによる実態調査を実施した。その調査結果を報告するとともに，乳癌術後乳房再建の問題点と今後の展望につき報告する。

調査方法と対象

2007年4月に郵送によるアンケート調査を実施した。対象は，全国の日本形成外科学会認定施設および教育関連施設（322施設）とした。アンケート項目は，病院のプロフィール，乳癌治療の診療実態，乳房再建の診療実態，一期的乳房再建の診療実態，二期的乳房再建の診療実態，今後の乳房再建のあり方に関する内容とし，形成外科医のアンケート案に乳腺外科医の意見を加え作成した（**表1**）。また，全国の日本乳癌学会認定施設および教育関連施設（609施設）に対して行ったアンケート調査との比較検討も行った。

調査結果

回答は322施設中212施設より得られ，回収率は65.8％であった。設問によっては無回答があったため，回答が得られた212施設を100％とした場合の設問ごとの回答率または設問ごとの回答総数を示し，各回答の占める割合は回答総数に対する％で表示した（小数点第2位を四捨五入）。

1．病院のプロフィール

アンケート調査の回答が得られた病院の形態は総合病院が140施設（66.0％），大学病院が62施設（29.2％），医院・診療所が4施設（1.9％），専門病院（がんセンターなど）が4施設（1.9％），単科病院が2施設（0.9％）であった。

2．乳癌治療の診療実態

アンケート調査の回答が得られた病院のうち乳癌治療を行っている施設は199施設（93.9％），行っていない施設は13施設（6.1％）であった。乳癌手術を施行している外科医は乳腺外科医が144施設，一般外科

表1　乳癌術後乳房再建に関するアンケート用紙

貴院の乳房再建の現状についてのアンケート
質問は過去1年間の現状でお答え下さい。

1．貴院のプロフィールにつきお伺いします。
Q1．貴院は次のうちどれですか。
□a. 大学病院　□b. 総合病院　□c. 単科病院　□d. 医院・診療所

2．乳癌治療につきお伺いします。
Q1．貴院は乳癌治療を施行していますか。
□a. している　□b. していない

Q2．貴院で乳癌手術は誰が行いますか。
□a. 乳腺外科医　□b. 一般外科医　□c. その他（　　）

3．乳房再建につきお伺いします。
Q1．2006年から乳房再建の保険点数が新設されたのはご存じですか。
□a. 知っている　□b. 知らない

Q2．乳房再建に興味がありますか。
□a. 非常に興味がある　□b. 少し興味がある　□c. 全く興味がない

4．一期的乳房再建につきお伺いします。
Q1．貴院での一期的乳房再建は年間約何例ですか。
□a. 0例　□b. 1－10例　□c. 11－20例　□d. 21－30例　□e. 31－40例
□f. 41－50例　□g. 51－100例　□h. 101例－

Q2．貴院で一期的乳房再建手術は誰が行いますか。
□a. 形成外科医　□b. 乳腺専門外科医　□c. 一般外科医　□d. その他（　　）

Q3．一期的乳房再建の再建方法は何ですか。（重複回答可）
□a. 広背筋皮弁　□b. 腹直筋皮弁　□c. free TRAM　□d. free DIEP
□e. Implant　□f. Expander＋Implant　□g. その他（　　）

Q4．一期的乳房再建があまり普及しない理由は何と考えますか。（重複回答可）
□a. 再発の可能性があるため。　□b. 術後の放射線治療があるため。
□c. 乳腺外科医からの紹介がないため。　□d. 患者が希望しないため。
□e. 手術枠が少なく、一期再建に対応できないため。
□f. 乳腺外科の手術時間帯に対応できないため。
□g. 患者が再建についての情報を知らないため。
□h. その他（　　）

5．二期的乳房再建につきお伺いします。
Q1．貴院での二期的乳房再建は年間約何例ですか。
□a. 0例　□b. 1－10例　□c. 11－20例　□d. 21－30例　□e. 31－40例
□f. 41－50例　□g. 51－100例　□h. 101例－

Q2．二期的乳房再建の再建方法は何ですか。（重複回答可）
□a. 広背筋皮弁　□b. 腹直筋皮弁　□c. free TRAM　□d. free DIEP
□e. Implant　□f. Expander＋Implant　□g. その他（　　）

Q3．二期的乳房再建患者はどのように受診されますか。（重複回答可）
□a. 貴院の外科医からの紹介　□b. 他院の外科医からの紹介　□c. 患者が直接受診
□d. その他（　　）

6．今後の乳房再建のあり方についてお伺いします。
Q1．今後乳房再建は一期的・二期的いずれが増加すると思われますか。
□a. 一期的乳房再建　□b. 二期的乳房再建　□c. いずれとも言えない

Q2．今後増加する乳房再建方法は何と考えますか。（重複回答可）
□a. 広背筋皮弁　□b. 腹直筋皮弁　□c. free TRAM　□d. free DIEP
□e. Implant　□f. Expander＋Implant　□g. その他（　　）

Q3．今後乳房再建を増加させるために特に必要な要因は何と考えますか。（重複回答可）
□a. 乳腺外科医との連携
□b. 乳癌患者への啓蒙
□c. 手術時間の増加
□d. 形成外科医の増員
□e. 有効な再建手術の開発
□f. Implant の保険適用
□g. その他（　　）

以上ご協力ありがとうございました。

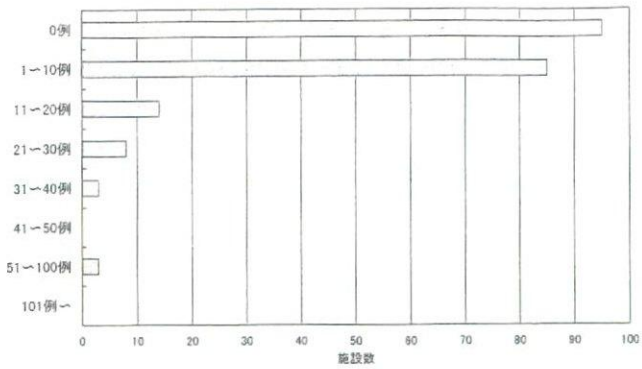

図1　一期的乳房再建の年間症例数

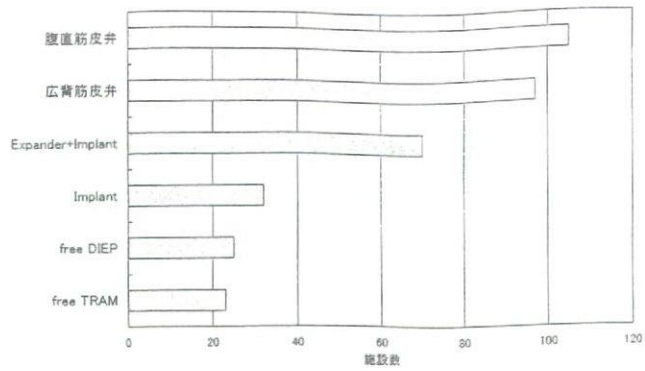

図2　一期的乳房再建の再建方法

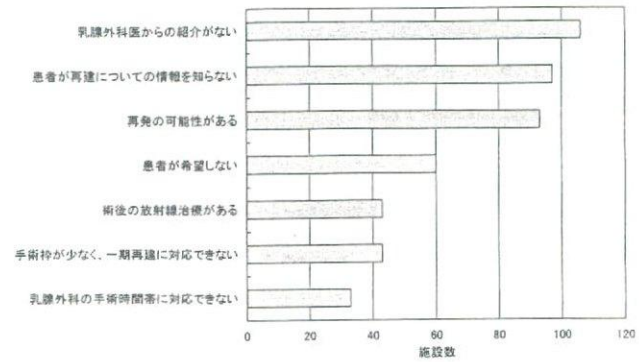

図3　一期的乳房再建が普及しない理由

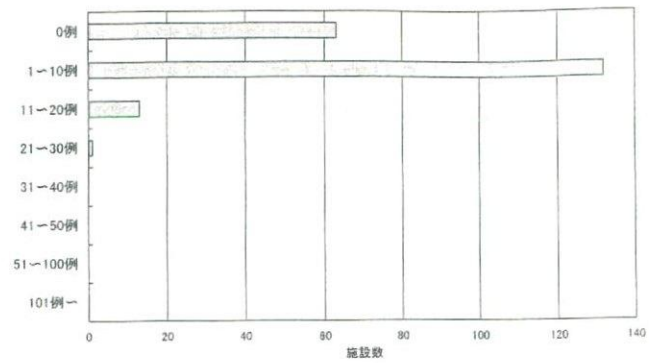

図4　二期的乳房再建の年間症例数

医が63施設であった。

3．乳房再建に対する関心度

2006年から新設された乳房再建の保険点数について知っていると答えた施設は176施設（83.0％），知らないと答えた施設は36施設（17.0％）であった。

乳房再建に興味があるか否かに関しては，非常に興味がある：135施設（63.7％），少し興味がある：68施設（32.1％），全く興味がない：9施設（4.2％）であった。

4．一期的乳房再建の診療実態

一期的乳房再建の年間症例数は，0例が最も多く，1～10例，11～20例と続き，回答総数の84.9％は10例以下であった（**図1**）。

一期的乳房再建手術の担い手は，形成外科医が165施設（93.2％）と最も多く，次いで乳腺外科医：10施設（5.6％），一般外科医：2施設（1.1％）であった。

一期的乳房再建の再建方法は，腹直筋皮弁が最も多く105施設（49.5％），次いで広背筋皮弁：97施設（45.8％），Expander + Implant：70施設（33.0％）と続いていた（**図2**）。

一期的乳房再建があまり普及しない理由に関しては，乳腺外科医からの紹介がないためが最も多く106施設（50.0％），次いで患者が再建についての情報を知らないため：97施設（45.8％），再発の可能性があるため：93施設（43.9％）と続いていた（**図3**）。

5．二期的乳房再建の診療実態

二期的乳房再建の年間症例数は，1～10例が最も多く，0例，11～20例と続き，回答総数の92.0％は10例以下であった（**図4**）。

二期的乳房再建の再建方法は，腹直筋皮弁が最も多く125施設（59.0％），次いで広背筋皮弁：98施設（46.2％），Expander + Implant：78施設（36.8％）と続いていた（**図5**）。

二期的乳房再建患者の受診方法は，自院の外科医からの紹介が最も多く148施設（69.8％），次いで他院の外科医からの紹介：98施設（46.2％），患者が直接受診：75施設（35.4％）と続いていた。

6．今後の乳房再建のあり方について

今後乳房再建は一期的・二期的いずれが増加するかに関しては，一期的乳房再建が最も多く91施設（42.9％），次いでいずれとも言えない：83施設（39.2％），二期的乳房再建：36施設（17.0％）と続いていた。

今後増加すると考える乳房再建方法は，Expander + Implantが最も多く147施設（69.3％），次いでImplant：84施設（39.6％），free DIEP flap：54施設（25.5％）と続いていた（**図6**）。

今後乳房再建を増加させるために必要な要因に関し

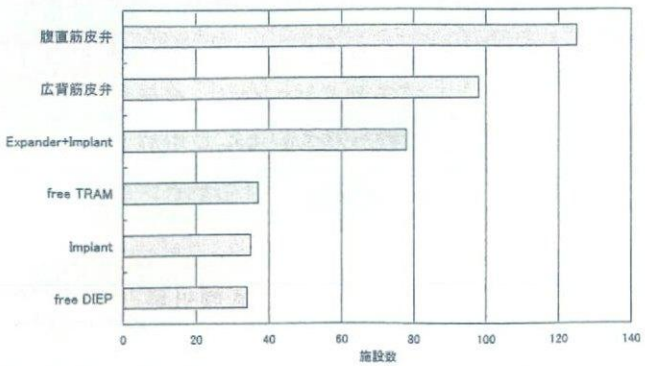

図5　二期的乳房再建の再建方法

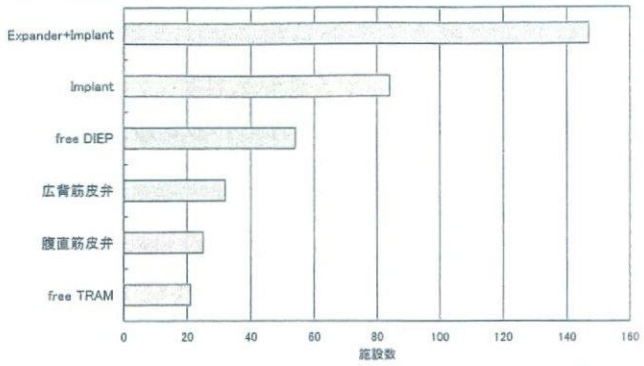

図6　今後増加すると考える乳房再建方法

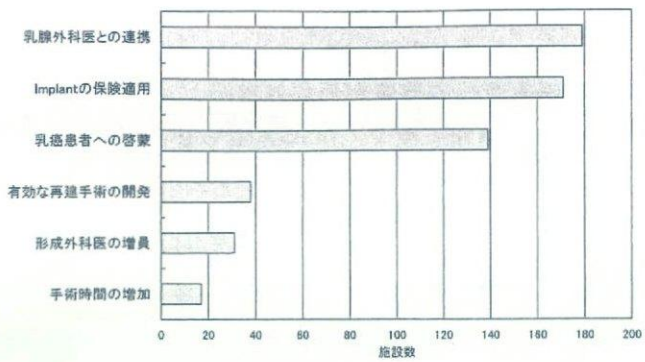

図7　今後乳房再建を増加させるために必要な要因

ては，乳腺外科医との連携が最も多く 179 施設（84.4 %），次いで Implant の保険適用：171 施設（80.7 %），乳癌患者への啓蒙：139 施設（65.6 %）と続いていた（**図7**）。

7．日本乳癌学会認定施設および教育関連施設に対するアンケート調査

全国の日本乳癌学会認定施設および教育関連施設に対しても同様な内容のアンケート調査を行った。回答は 609 施設中 356 施設より得られ，回収率は 58.5 %であった。その詳細は乳癌関連雑誌に掲載予定であるが，比較検討する項目については考察のなかで触れる。

考　察

今回は全国の日本形成外科学会認定施設・教育関連施設に対して，病院のプロフィール，乳癌治療の診療実態，乳房再建に対する関心度，一期的乳房再建の診療実態，二期的乳房再建の診療実態，今後の乳房再建のあり方の 6 項目に関して診療実態調査を行った。その結果，乳房再建の現状と今後の検討課題をある程度数値化し，明示することができた。部分的に設問内容や解釈に問題があろうことは否めないが，得られた結果につき若干の考察を加える。

1．病院のプロフィール

今回の調査では日本形成外科学会認定施設・教育関連施設を対象として行ったため調査対象病院は多くの病床数を有する医育機関附属病院や公的・私的総合病院がほとんどであった。したがって，今回の調査結果では認定施設・教育関連施設に選定されていない個人開業医院や小規模病院の形成外科医の意見は反映されていない。

2．乳癌治療の診療実態

アンケート調査の回答が得られた病院の 93.9 %が乳癌治療を行っており，乳癌治療が多くの病院で普通に行われている実態が浮き彫りとなっている。乳癌手術の担い手は乳腺外科医が 67.9 %となっており，従来は専門外の一般外科医によって行われていた手術が大半は専門医によって行われるようになった。乳腺外科医へのアンケート調査によると常勤の乳腺外科医は一施設あたり 2.3 人，乳腺専門医は 0.9 人であった[1]。乳腺専門医が各施設で増加しており，より専門性が問われる分野になったことが分かる。

3．乳房再建に対する関心度

2006 年から乳房再建の保険点数が新設されたことに関する認知度は 83.0 %と高率を示し，関心の高さがうかがわれた。また，乳房再建への興味に関しては“非常に興味がある”，“少し興味がある”をあわせると 95.8 %であり，形成外科医にとっては関心の高い分野であることが示された。乳腺外科医へのアンケート調査によると“非常に興味がある”，“少し興味がある”をあわせると 98.0 %であり，形成外科医と同様に関心が高いことが分かる[1]。ただ，“非常に興味がある”だけを比較すると形成外科医が 63.7 %，乳腺外科医は 48.9 %であり，形成外科医のほうが関心度は高いと思われた。

4．一期的乳房再建の診療実態

一期的乳房再建の年間症例数は，回答総数の 84.9 %が 10 例以下であり，実施率は非常に低いことが分かる。年間症例数が 51 ～ 100 例と比較的多い施設は 3 施設のみであった。

一期的乳房再建手術の担い手は，形成外科医が77.8％と最も多かったが，日本形成外科学会認定施設や教育関連施設であっても乳腺外科医4.7％，一般外科医0.9％が乳房再建を手がけている実態が明らかとなった。

一期的乳房再建の再建方法は，腹直筋皮弁が49.5％，広背筋皮弁が45.8％であり，従来から行われている自家組織による再建が最も多いことが示された。Expander + Implantによる再建は33.0％であり，保険適用ではないが再建手技としては増加傾向であることが分かる。

一期的乳房再建があまり普及しない理由に関しては，乳腺外科医からの紹介がないためが50.0％と最も多く，乳腺外科医との連携が不十分な実態が明らかとなった。再発の可能性があるためが43.9％あり，乳腺外科医からの紹介がない理由の一つと考えられた。次いで患者が再建についての情報を知らないためが45.8％であり，医師からの再建に関する説明不足と再建についての社会的認知度の低さが推測される。

5．二期的乳房再建の診療実態

二期的乳房再建の年間症例数は10例以下が92.0％であり，最も症例数の多かった21～30例は1施設しかなく，実施率の低さが際立っている。

二期的乳房再建の再建方法は，腹直筋皮弁59.0％，広背筋皮弁46.2％であり，一期再建と同様に従来から行われている自家組織による再建が最も多いことが分かる。Expander + Implantによる再建が36.8％と増加傾向である。

二期的乳房再建患者の受診方法は，自院の外科医からの紹介が69.8％と最も多く，次いで他院の外科医からの紹介が46.2％と続いており，外科医からの紹介が多いが，再建実施症例数から推測すると紹介患者数はまだまだ少ないと思われる。また，患者が直接受診する受診形態も35.4％あり，乳癌患者自身がインターネットや患者どうしの口コミで乳房再建を希望する率も増加傾向であることが分かる。

6．今後の乳房再建のあり方について

今後の乳房再建は“一期的乳房再建が増加する”と答えた施設が42.9％と多かったが，次いで“いずれとも言えない”も39.2％と続いていた。乳腺外科医へのアンケート調査においても“いずれとも言えない”が37.9％，“一期的乳房再建”が33.1％，“二期的乳房再建”が27.8％とほぼ拮抗しており，術者の考え方が分かれるところであることが示唆される[1]。

今後増加すると考える乳房再建方法は，Expander + Implantが69.3％と最も多く，次いでImplantが39.6％であり，将来的には最も低侵襲な人工乳房による再建が増えることが予測される。また，自家組織による再建もfree DIEP flapが25.5％と最も増加する再建材料として予測されており，患者にとって犠牲の少ない手術が求められていることが示された。

今後乳房再建を増加させるために必要な要因に関しては，乳腺外科医との連携が84.4％と最も多かった。乳腺外科医へのアンケート調査においても形成外科医との連携が73.0％と最も多く，乳腺外科と形成外科のチーム医療がお互いの共通認識として最重要課題であることが判明した。次いでImplantの保険適用が80.7％であり，乳腺外科医へのアンケート調査においても67.7％を占めており，Implantをもっと自由に使いたいというのが共通の願いであることが分かる。続いて乳癌患者への啓蒙が形成外科医：65.6％，乳腺外科医：41.6％と多く，市民講座や患者の会を通じての啓蒙活動も必要であろうと考えられた。さらに，より低侵襲な再建技術の開発を進め，再建手術に消極的な形成外科医に対しても，その普及のために啓蒙活動を行う必要があると思われた。

ま と め

今回，全国の日本形成外科学会認定施設・教育関連施設に対して，病院のプロフィール，乳癌治療の診療実態，乳房再建に関する関心度，一期的乳房再建の診療実態，二期的乳房再建の診療実態，今後の乳房再建のあり方に関する6項目について診療実態調査を行い，その結果を報告した。今回の調査結果は，形成外科としての今後の乳房再建治療の拡充に向けた方向性の検討などに際しての参照すべき資料になるものと思われる。

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文　献

1）矢野健二，玉木康博：乳癌術後乳房再建に関するアンケート調査．乳癌の臨床，**22**（6）：in press, 2008.

調査報告

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乳癌術後乳房再建術に関するアンケート調査

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Results of Questionnaire Survey on The Actual Medical Status of Breast Reconstruction：Yano K[*1] and Tamaki Y[*2] ([*1]Department of Plastic Surgery, [*2]Department of Breast and Endocrine Surgery, Osaka University of Medicine)

This time, a questionnaire survey for breast surgeons was carried out as a contribution to a future directivity because the trait and task become clear by grasping and quantifying the present status of breast reconstruction. The questionnaires were distributed to all certified facilities and teaching institutions of breast surgery (609 facilities) throughout the country. The questionnaire items were made about the state or the profile of a hospital, the actual status of breast carcinoma treatment, the actual status of breast reconstruction, the actual status of immediate breast reconstruction, the actual status of secondary breast reconstruction, and future breast reconstruction. Replies to this questionnaire survey were received from 356 out of 609 institutions ; i.e., the reply rate was 58.5%. In this article, we present the survey results as well as the current problems and the future prospects in the field of breast reconstruction after mastectomy.

Key words：Questionnaire survey, Breast reconstruction, Breast surgery

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はじめに

乳癌術後の乳房再建がわが国でも施行されるようになって20年以上が経過し，ようやく一般的にも認知されるようになってきた．そして，2006年4月から乳房再建術（乳房切除後一期的に行うもの，乳房切除後二期的に行うもの）が保険適応となり，今後ますます増加傾向を示すものと思われる．しかし，乳房再建においてもさまざまな問題点が山積しており，今後の動向を探る上でも現状を把握することが重要と思われる．そこで，乳癌術後乳房再建の現状を把握し，数量化することによりその特色と課題を知り，今後の方向性に資することを目的として乳腺外科医と形成外科医を対象としたアンケートによる実態調査を実施した．その調査結果を報告するとともに乳癌術後乳房再建の問題点と今後の展望につき報告する．

1.　調査方法と対象

2007年4月に郵送によるアンケート調査を実施した．対象は，全国の日本乳癌学会認定施設および教育関連施設（609施設）とした．アンケート項目は，病院のプロフィール，乳癌治療の診療実態，乳房再建の診療実態，一期的乳房再建の診療実態，二期的乳房再建の診療実態，今後の乳房再建のあり方に関する内容とした（**表1**）．また，全国の日本形成外科学会認定施設および教育関連施設（322施設）に対して行ったアンケート調査との比較検討も行った．

2.　調査結果

回答は609施設中356施設より得られ，回収率は58.5%であった．設問によっては無回答があったため，回答が得られた356施設を100%とした場合の設問ごとの回答率または設問ごとの回答総数を

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