

Postoperative management of transtibial amputations in VA hospitals

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Abstract—Rigid plaster dressings and immediate postoperative prostheses (IPOP) in patients undergoing transtibial amputations have been reported to reduce pain and healing time, prevent knee flexion contractures, and expedite early ambulation compared to soft dressings. Yet, despite the reported benefits, surgical adoption of (conventional) rigid dressings and IPOP has been inconsistent. The purpose of this study was to determine the current postoperative transtibial amputation dressing practices in VA hospitals. A six-item questionnaire was sent to 134 surgeons at the 117 VA hospitals where transtibial amputations were performed in fiscal year 1999. Responses were received from 83% of the surgeons. During the 1999 study year, surgeons performing transtibial amputations used soft dressings on 67% of patients, conventional rigid dressings with no intent to apply a foot attachment on 14% of patients, removable rigid dressings on 14% of patients, and IPOP (almost exclusively without a foot) on 5% of patients. The application of a rigid dressing or IPOP did not correlate well with the total number of transtibial amputations performed by the surgeon, hospital bed size, or academic affiliation.

Key words: *immediate postoperative prostheses, removable rigid dressings, rigid dressings, soft dressings, transtibial amputations.*

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INTRODUCTION

The goal of postoperative management in patients with transtibial amputations is to ensure primary wound healing and pain control, prevent edema, shape the residual limb for prosthetic fit, and, to the extent possible, prepare the patient for restoration of function and quality of life. Conventional postoperative treatment for transtibial amputation involves soft dressings consisting of sterile gauze and fluff followed by a compressive bandage of elastic wrap. This dressing strategy is straightforward, requires little time, uses widely available materials, and allows wound checks. However, these dressings have the disadvantage that application of the elastic wrap can generate high pressures that are detrimental to skin survival (1). In addition, prolonged immobilization of the patient—required for pain control following treatment with conventional soft dressings—has been reported to lead to pulmonary complications (2–4). If earlier ambulation were possible, these complications might be minimized.

An alternative technique involves the application of a plaster cast with or without foot attachments. Weiss in Poland, Berlement in France, and Burgess and Zetl in the United States introduced these techniques (5–11). The Immediate Post Operative Prostheses (IPOP) consists of a

prosthetic socket hand molded from plaster bandages with a prosthetic foot and pylon attached. These rigid dressings are applied in the operating room either immediately after surgery or within 7–10 days. These techniques all share the principle of immobilizing the knee joint with a thigh-high cast and applying a supracondylar molding of the cast to help prevent the cast from rotating or pistoning. **Figure 1** displays common postoperative dressings used for persons undergoing transtibial amputation.

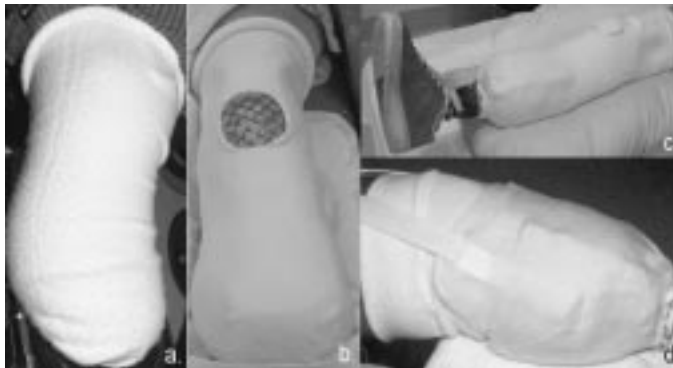


Figure 1.

Types of postoperative dressings for transtibial amputation: a) soft dressing, b) conventional rigid dressing, c) IPOP with foot, and d) removable rigid dressing.

Rigid dressings and IPOP have been reported to reduce pain and healing time, increase tolerance to weight bearing, and enable early ambulation compared to conventional dressings (2,3,12–23). There are four studies that directly compare rigid dressing techniques *versus* soft dressings (12,13,18,19). All four studies have methodologic difficulties when held to today's standard of the randomized clinical trial. However, these four trials do report equal or improved healing, less pain, improved rehabilitation, a positive mental attitude, and shorter hospital stay. All of these studies also emphasize the skill and care needed to apply these techniques.

Wu introduced a technique termed the removable rigid dressing. This technique involves application of a short cast that mimics a transtibial prosthetic socket. It does not extend proximally onto the thigh, but since it can be slipped off just like a transtibial socket, it does permit frequent observation of the stump while still providing some immobilization of soft tissue and prevention of trauma (24–26). A removable rigid dressing does not immobilize the knee, and therefore patients can still be at risk of knee flexion contractures or traction on the incision line due to knee motion.

In 1970, soon after the introduction of IPOP, a survey of transtibial amputee management in eight VA hospitals was initiated. Following a short trial, four hospitals abandoned the procedure and were replaced with four other facilities for the study (16). Wide variation was reported for both postoperative dressing practices and by the personnel applying rigid dressings at each hospital [surgeons (n=2), surgeons and prosthetists (n=3), prosthetists (n=2), and an orthopedic aide (n=1)]. The first routine cast change was made between postoperative day five and postoperative day 14 in all eight hospitals.

Researchers in our Center of Excellence retrospectively reviewed a random sample of VA hospital amputation operative reports and discharge summaries. Among those sampled were 88 patients who underwent transtibial amputations between 1992 and 1996. Soft dressings were used for 66 percent of patients, rigid dressings for 16 percent, and IPOP for 6 percent. VA hospital discharge data for fiscal years 1989–1998 showed that transtibial amputations accounted for 25 percent of all lower-limb amputation discharges (27). Among VA hospitals performing transtibial amputations during the 2-year period 1997–1998 (27), only 37 percent performed 20 or more procedures.

There is little additional information on posttranstibial amputation management with rigid dressings or IPOP in VA hospitals. Therefore, the purpose of this research was to 1) assess the frequency of postoperative dressing types used to treat transtibial amputees, 2) compile qualitative information regarding personnel involved in application of rigid dressings and IPOPs in the operating room, and 3) correlate choice of dressing type with surgical discipline and frequency of transtibial amputation in the facility.

METHODS

Researchers and clinicians at the VA Puget Sound Health Care System in Seattle, WA, developed a questionnaire addressing transtibial amputation postoperative management practices. The questionnaire protocol was reviewed and approved by the University of Washington Human Subjects Committee. The questionnaire was sent to every surgeon at each of the 117 VA hospitals who performed at least one transtibial amputation during fiscal year 1999. Names and addresses of surgeons were obtained through contact with each facility. A total of 134 surgeons were identified and received a mailed copy of

the questionnaire. Those not returning their questionnaires within 3 weeks received a follow-up letter, and 2 weeks later, a phone call was made to those who had not responded.

The questionnaire asked for the number of transtibial amputations performed in the past year, for postoperative management strategies employed by surgical indication, and for details on specific use of soft dressings, conventional rigid dressings, removable rigid dressings, and IPOP with a prosthetic foot and pylon attached. Facility characteristics such as the number of beds, affiliation with a teaching hospital, and geographical location were obtained from hospital websites and by telephone contact.

Frequency distributions were computed for all study variables. Spearman's correlation coefficients were calculated to determine the association between the percentage of transtibial amputees treated by dressing types and surgical specialty. Linear regressions and Pearson's correlation coefficients were used to determine the association between the percentage of amputees treated with rigid dressings or IPOP and facility characteristics such as the total number of transtibial amputations performed and the number of beds. A two-tailed t-test of the difference in mean amputations was performed comparing sites doing rigid dressings or IPOP and those doing soft dressings. Logistic regression was used to find the relationship between dressing type and a hospital's academic affiliation and geographic region. Analyses were performed with the use of Stata 6.0 software (28).

RESULTS

Of the 134 surgeons receiving the questionnaire, 111, or 83 percent, responded. Excluded from the analysis was one incomplete questionnaire and questionnaires from nine surgeons who did not perform transtibial amputations during the study year. Findings are reported for 101 surgeons performing transtibial amputations at 92 VA hospitals. In rank order, indications for transtibial amputation were diabetes, vascular disease, trauma, neoplasm, and other. Rigid and IPOP dressings were used significantly more often in patients with trauma and neoplasms than in persons with diabetes and vascular disease. Surgeons performing transtibial amputations used soft dressings on 67 percent of patients, conventional rigid dressings with no intent to apply a foot attachment on 14 percent of patients, removable rigid dressings on 14 percent of

patients, and an IPOP (almost exclusively without a foot) on 5 percent of patients. A small number of respondents reported infrequent use of conventional soft dressings with knee immobilizers, soft dressing with posterior splints and skin traction, and Unna boots.

Figure 2 shows that soft dressings were used by 86 percent of vascular surgeons, 79 percent of general surgeons, and 54 percent of orthopedic surgeons. The use of rigid dressings following transtibial amputation varied widely by surgical disciplines, and orthopedic surgeons (17 percent) were significantly more likely to apply rigid dressings or IPOP than general (9 percent) or vascular (7 percent) surgeons.

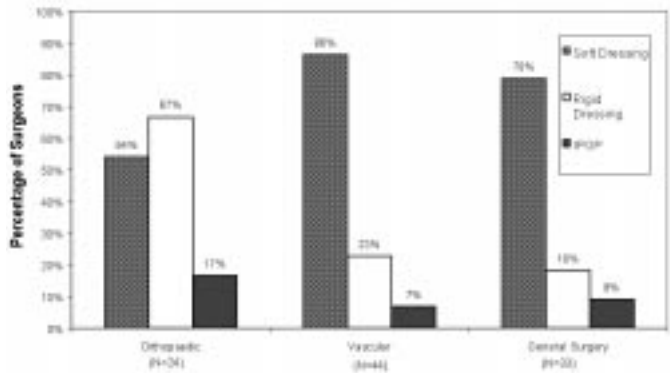


Figure 2. Surgical preference for postoperative dressing in veterans with transtibial amputations. Surgeons selected all dressing types used, therefore percentages sum to over 100%.

Figure 3 shows the range of healthcare providers applying the rigid dressing. In rank order this was attending physicians, resident physicians, prosthetists, cast technicians, nurses, physician's assistants, and physical therapists or other staff members. Of those who applied soft dressings postoperatively, 13 percent converted to rigid dressings or IPOP within 7 to 10 days. Half of rigid or IPOP dressings were changed in 3 to 6 days, 34 percent were changed in 7 days, and the remainder in 8 plus days.

Facilities were divided into two groups depending on the application of rigid dressings or IPOP versus other postoperative dressings. A t-test showed that the difference in the mean number of amputations performed in these facility groups was not significant (p=0.91).

There was no statistically significant correlation between hospitals providing rigid dressings and those with academic affiliations.

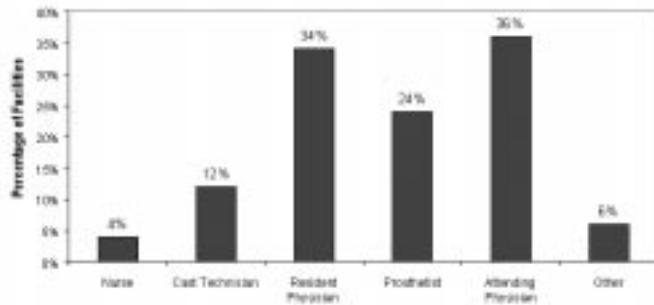


Figure 3. Individual applying rigid dressing or IPOP in VA hospitals. Teams consisting of more than one staff person applied dressings at several facilities, therefore percentages sum to over 100%.

Geographic variations in patterns of postoperative management were discernible. In this analysis, the US was divided into the following eight geographic regions: East Coast, Southeast, South, West, Midwest, Central, Southwest, and the Northwest. The results of the logistic regression analysis, suggestive though not statistically significant, indicated that surgeons in the Southeastern United States, comprising VISNs 6, 7, 8, and 9, were less likely to apply rigid dressings compared to those in other parts of the country.

DISCUSSION

This questionnaire provided information on postoperative management practices of surgeons performing transtibial amputations in VA Hospitals. The 83-percent response rate indicated a high level of interest in this

topic. While some surgeons applied only conventional soft dressings, others used a combination of soft, rigid, removable rigid dressings, IPOP, or other strategies. The wide variation in postoperative transtibial amputation practice suggests other factors may be present that influence postoperative dressing selection, such as practice conventions, training, availability of skilled staff to apply rigid dressings, or other health care factors. Questionnaire results showed that surgical specialty was associated with the choice of postoperative management technique and orthopedic surgeons were more likely to apply rigid dressings than were vascular or general surgeons. This finding was anticipated given the increased focus on rigid dressings in many orthopedic-surgery training programs. Some postoperative practices clustered by site; e.g., 83 percent of removable rigid dressings were done at nine VA hospitals.

Despite the reported benefits, there are two reasons why surgical adoption of rigid dressings and IPOP is limited. First, a skilled surgical and prosthetic team is required for successful application and rehabilitation of patients treated with rigid dressings or IPOP; thus this technique may not be feasible in hospitals lacking these trained personnel (12,16,29,30). Second, in patients with vascular disease, rigid dressings present the disadvantage that the wound cannot be readily examined and early ambulation with an IPOP might traumatize the stump with a marginal blood supply, thereby resulting in failure of the transtibial amputation (17).

The extent of patient benefit resulting from different postoperative dressing types remains unresolved. Future studies are needed that will address the impact of postoperative transtibial amputation dressings on patients' physical and functional outcomes together with costs incurred by the patient and the health care system.

APPENDIX

1. How many transtibial (below the knee) amputations did you perform in the past year? (n=_____)
2. On approximately what percent of these patients did you use the following five types of postoperative management in the *operating room*?

Type of dressing applied in the OR	Use on _____% of your patients
• Soft dressing (<i>kerlix, gauze, ace wrap</i>)	67
• Conventional Rigid Dressing, no intent to apply foot (<i>rigid plaster cast/splint, extends from above the knee to the distal end of the residual limb, cannot be removed</i>)	14
• IPOP (Immediate postoperative prosthesis) without foot (<i>rigid plaster dressing without foot, plan to attach foot within 7–10 days</i>)	5
• IPOP with foot (<i>rigid plaster dressing with foot and pylon, fitted within 24 hours</i>)	—
• Removable rigid dressing (<i>rigid plaster cast, extends from the knee joint to the end of the distal residual limb, can be removed</i>)	14
	100%

3. Of the patients you treated with soft dressing in the operating room, what percent were converted to rigid dressing or IPOP within 7–10 days? (*Indicate % _____*)

4. Who applies the rigid dressing or IPOP? Indicate with an **X**.

a. nurse	_____	d. prosthetist	_____
b. cast technician	_____	e. attending physician	_____
c. resident physician	_____	f. other	_____

5. How often is the rigid dressing or IPOP changed? Indicate with an **X**.

a. every 3–6 days	_____	d. every 14 days	_____
b. every 7 days	_____	e. every 15 days or more	_____
c. every 8–13 days	_____		

6. For the following types of patients, what kind of dressing(s) did you use? Indicate with an **X** all that apply.

Type of patient	Soft dressing	Rigid dressing no intent to apply foot	IPOP without foot, plan to attach foot	IPOP with foot	Removable rigid dressing
a. Trauma					
b. Neoplasm					
c. Dysvascular					
d. Diabetic					
e. All others					

REFERENCES

1. Troup IM. Pre-operative and post-operative care: stump environment. In: Murdoch and Donovan, editors. Amputation surgery and lower limb prosthetics. 1988; p. 21–8.
2. Moore WS, Hall AD, Wylie EJ. Below knee amputation for vascular insufficiency—experience with immediate postoperative fitting of prosthesis. *Arch Surg* 1968;100:886–93.
3. Weinstein E, Livingston S, Rubin JR. The immediate postoperative prosthesis (IPOP) in ischemia and septic amputations. *Am Surg* 1988;54:386–9.
4. Cohen SI, Goldman LD, Salzman EW, Goltzer DJ. The deleterious effect of immediate postoperative prosthesis in below-knee amputation for ischemic disease. *Surgery* 1974;76:992–1001.
5. Berlemont M, Weber R, Willot JP. Ten years of experience with the immediate application of prosthetic devices to amputees of the lower extremities on the operating table. *Prosth Internat* 1969;3:8.
6. Berlemont M. Notre experience de l'appareillage precoce des amputés des membres inférieurs aux établissements helio-marins de berck. *Ann Med Phys* 1961;4:4.
7. Weiss M, Gielzynski A, Wirski J. Myoplasty-immediate fitting-ambulation. Proceedings of the 10th annual Research in Rehabilitation, World Congress of the International Society, Wiesbaden, Germany; September 1966.
8. Weiss M. The prosthesis on the operating table from the neurophysiological point of view. Report of the Workshop Panel on Lower Extremity Prosthetic Fitting, Committee on Prosthetics Research and Development, National Academy of Sciences. February 1966.
9. Burgess EM, Romano RL, Zettl JH. The management of lower-extremity amputations: surgery, immediate postsurgical prosthetic fitting rehabilitation. Bulletin TR 10-6, US Government Printing Office, 1969.
10. Zettl JH, Burgess EM, Romano FL. The interface in the immediate postsurgical prosthesis. *Bull Prosthet Res* 1969;8:10–2.
11. Zettl JH. Immediate postsurgical prosthetic fitting: the role of the prosthetist. *Am J Phys Ther* 1971;51:144.
12. Baker WH, Barnes RW, Schurr DG. The healing of below-knee amputations—a comparison of soft and plaster dressings. *AJS* 1977;133:716–8.
13. Barber GG, McPhail NV, Scobie TK, Brennan MCD, Ellis CC. A prospective study of lower limb amputations. *Canadian J Surg* 1983;26:339–41.
14. Cummings V. Immediate rigid dressing for amputees—advantages and misconceptions. *New York State J Med* 1974;980–3.
15. Folsom D, King T, Rubin J. Lower-extremity amputation with immediate postoperative prosthetic placement. *AJS* 1992;164:320–2.
16. Kihn RB, Golbranson FL, Hutchinson RH, Moore WS, Premer RF. The immediate postoperative prosthesis—an evaluation. *Arch Surg* 1970;101:40–4.
17. Kane TJ, Pollak E. The rigid *versus* soft postoperative dressing controversy: a controlled study in vascular below-knee amputees. *Am Surg* 1980;4:244–7.
18. Mooney V, Harvey JP, McBride E, Snelson, R. Comparison of postoperative stump management: plaster vs. soft dressings. *J Bone and Joint Surg* 1971;53-A:241–9.
19. Moore WS, Hall AD, Lim RC. Below the knee amputation for ischemic gangrene—comparative results of conventional operation and immediate postoperative fitting technique. *AJS* 1972;124:127–34.
20. Nicholas GG, DeMuth WE. Evaluation of use of the rigid dressing in amputation of the lower extremity. *Surg Gyn Ob* 1976;143:398–400.
21. Russek AS. Immediate postsurgical fitting of the lower extremity amputee—research experience with 175 cases. *Med Clin N Am* 1969;53:3.
22. Sarmiento A, May BJ, Sinclair WF, McCollough NC, Williams EM. Lower-extremity amputation—the impact of immediate postsurgical fitting. *Clin Orthop Rel Res* 1970;68:22–31.
23. Stolov WC, Burgess EM, Romano RL. Progression of weight bearing after immediate prosthetic fitting following below-knee amputation. *Arch Physical Med Rehabil* 1971;491–502.
24. Wu Y, Flanigan DP. Rehabilitation of the lower-extremity amputee with emphasis on a removable below-knee rigid dressing, in gangrene and severe ischemia of the lower extremities. NY: Grune and Statton; 1978.
25. Wu Y, Keagy RD, Krick HJ, Stratigos JS, Betts HB. An innovative removable rigid dressing technique for below-the-knee amputation. *J Bone Joint Surg* 1979;61A:724–9.
26. Wu Y, Brncick MD, Krick HJ, Putnam TD, Stratigos JS. Technical notes scotchcast PVC interim prosthesis for below knee amputees. *Bull Prosthet Res* Fall 1981.
27. Mayfield JA, Reiber GE, Maynard C, Czerniecki JM, Caps MT, Sangeorzan BJ. Lower limb amputation in the Veterans Health Administration 1989 to 1998. VA Center of Excellence for Limb-Loss Prevention and Prosthetic Engineering Technical Report; 1999.
28. StataCorp. Stata Statistical Software: Release 6.0. College Station, TX. Stata Corporation; 1999.
29. Editorial. IPOP-miracle, menace or gimmick? *Lancet* 1975;620–1.
30. Rheinstein J. Is post-operative prosthesis beneficial after amputation? In *Motion* 2000;10:59–62.