Baclofen pump pocket infection: a case report of successful salvage with muscle flap

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ABSTRACT

Programmable pump for continuous infusion of intrathecal baclofen, an agonist of the inhibitory neurotransmitter gamma-aminobutyric acid, is nowadays being widely used to control spasticity. The most common complications leading to explantation of the pumps are skin breakdown and infection at the pump implantation site which cannot be effectively treated without pump removal. We report a 37-year-old man who developed a baclofen pump pocket infection that did not respond to antibiotic therapy. Because the continuation of intrathecal baclofen administration was critical to the patient, and because the high cost of the pump precluded its prompt replacement, the pump was salvaged using the ipsilateral rectus abdominis muscle that was elevated on its inferior vascular pedicle and wrapped around the pump. Abdominal skin was then approximated, leaving a small portion of exposed muscle overlying the refill site that was covered by a split-thickness skin graft. Continuous intrathecal baclofen administration was never discontinued. Three months later, the pump's refill site could be easily identified manually for pump refill. There were no signs of recurrent infection during the 2-year follow-up period.

Key words: Baclofen pump pocket infection ● Muscle flap ● Prosthetic salvage

INTRODUCTION

At present, baclofen (Lioresal®), an agonist of the inhibitory neurotransmitter gamma-aminobutyric acid, is the most widely used antispasmodic drug (1) and is the drug of choice to treat spasticity (2–4) particularly in paraplegic patients. Programmable pump for continuous infusion of intrathecal baclofen is nowadays being widely used with increasing success and has shown great efficacy and safety (5–15). The reduction of spasticity and spasms achieved with intrathecally delivered baclofen invariably leads to functional improvement and pain relief (7). This treatment modality is not, however, without complications. Several have been reported. Some are drug-related complications and side-effects such as respiratory depression, hypotension, seizures and drowsiness, and others are device related such as pump failure, catheter disconnection and infection (16–19). Pump placement complications include cerebrospinal fluid (CSF) collection (3·3%), constipation (2·9%), headache

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Key Points

- at present, baclofen (Lioresal®), an agonist of the inhibitory neurotransmitter gamma-aminobutyric acid, is the most widely used antispasmodic drug and is the drug of choice to treat spasticity particularly in paraplegic patients
- the reduction of spasticity and spasms achieved with intrathecally delivered baclofen invariably leads to functional improvement and pain relief
- this treatment modality is not, however, without complications

Key Points

- most common complications leading to explantation of the pumps are, skin breakdown and infection at the pump implantation site
- we report a case of baclofen pump pocket infection with wound dehiscence that was successfully treated with debridement, thorough irrigation, rectus abdominis muscle flap and split-thickness skin graft without removal of the pump and without discontinuation of baclofen administration
- a 37-year-old previously healthy man presented with the loss of consciousness secondary to acute hydrocephalus caused by a third ventricular low-grade astrocytoma
- the condition was initially treated with oral baclofen (Lioresal®) then a programmable baclofen pump (SynchroMed Infusion System: Medtronic Inc., Minneapolis, MN, USA) was inserted for continuous intrathecal administration
- three months later, the scar over the pump became erythematous and warm, however, without the signs of systemic infection
- the patient was then started on a 2-week course of teicoplanin (Tagocid®) causing the local inflammatory signs to subside
- because the continuation of intrathecal baclofen administration was critical to the patient, and because the high cost of the pump precluded its prompt replacement, it was judged that an attempt at its salvage was highly indicated
- there were no signs of recurrent infection during the 2-year follow-up period

(2·4%) and CSF leak (2·2%). The most common long-term complications are catheter kink or migration (4%) and infection (1·2%) (20). Most common complications leading to explantation of the pumps are, however, skin breakdown and infection at the pump implantation site (9).

Superficial wound infection at the site of implantation, although potentially serious, may be managed successfully with systemic antibiotics and local wound care. Meningitis is a rare but a more serious complication difficult to treat (21,22). It may be due to catheter contamination or more ominously actual intrareservoir infection. Although successful treatment with intravenous antibiotics (23) and intrareservoir administration of antibiotics simultaneously with baclofen without pump removal have been reported in few patients (23–25), in most instances, meningitis cannot be controlled while the pump is maintained in place (22). Pump pocket infection, on the other hand, as reported in the literature, cannot be effectively treated without pump removal and appropriate antibiotic therapy (5,16,12,23).

We report a case of baclofen pump pocket infection with wound dehiscence that was successfully treated with debridement, thorough irrigation, rectus abdominis muscle flap and split-thickness skin graft without removal of the pump and without discontinuation of baclofen administration (26). To our knowledge, this is the first case of pump salvage being reported with pump pocket infection after the failure of conservative management with intravenous antibiotics.

CASE REPORT

A 37-year-old previously healthy man presented with the loss of consciousness secondary to acute hydrocephalus caused by a third ventricular low-grade astrocytoma. Following acute vetriculostomy and subsequent surgical resection of the tumour, the patient developed a persistent vegetative state with diffuse spasticity. The condition was initially treated with oral baclofen (Lioresal®, Novartis Pharma AG, Basel, Switzerland) then a programmable baclofen pump (SynchroMed Infusion System; Medtronic Inc., Minneapolis, MN, USA) was inserted for continuous intrathecal administration. The pump was placed in the subcutaneous tissues in the right lower quadrant of the abdomen above the anterior rectus sheath, and the catheter was routed around the right flank.

Three months later, the scar over the pump became erythematous and warm, however, without the signs of systemic infection. CSF withdrawn from the shunt was negative for infection. The patient was then started on a 2-week course of teicoplanin (Tagocid®, Hoechst Marion Roussel, Inc., Kansas City, MO) causing the local inflammatory signs to subside. Few days later, these signs recurred complicated by a purulent discharge from a draining sinus at the superior border of the pump (Figure 1). Teicoplanin to which aztreonam (Azactam®, Bristol-Myers Squibb Company) was added few days later after the swab culture grew *Proteus mirabilis* was administered to no avail. Because the continuation of intrathecal baclofen administration was critical to the patient, and because the high cost of the pump precluded its prompt replacement, it was judged that an attempt at its salvage was highly indicated.

The pump was exposed and the pocket debrided and thoroughly irrigated with normal saline solution (intraoperative swab culture grew *Staphylococcus* coagulase-negative organisms). The ipsilateral rectus abdominis muscle was elevated on its inferior dominant vascular pedicle and wrapped around the pump completely covering it and covering the exposed

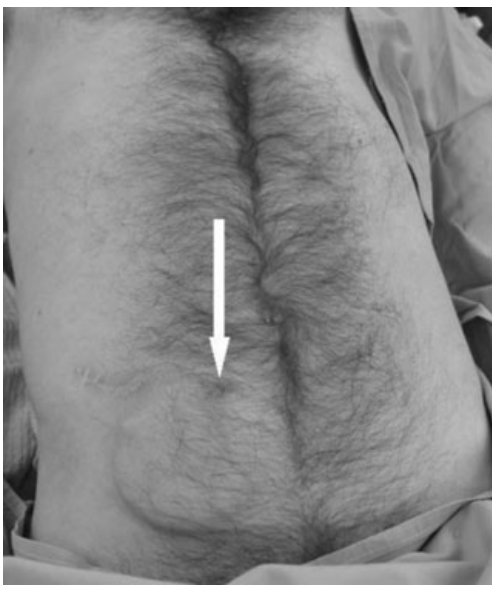

Figure 1. Draining sinus at the superior margin of the implant indicated by arrow.

portion of the catheter as well. Abdominal skin was then approximated, leaving a small portion of exposed muscle overlying the refill site. It was then covered by a split-thickness skin graft (Figure 2). A closed-system suction drain was placed between the pump and the muscular coverage and was removed 10 days later. Intravenous antibiotic administration was stopped 2 weeks after surgery. Continuous intrathecal baclofen administration was never discontinued. The pump's refill site could be easily identified manually, and the pump was successfully refilled 3 months later (Figure 3). There were no signs of recurrent infection during the 2-year follow-up period (Figure 4).

DISCUSSION

Wound infection is a dreadful complication in the presence of a foreign implant; however, not all postoperative wound infections affect the surgical implant. The ultimate proof of implant-associated infection requires the presence of clinical manifestations, intraoperative signs of infection adjacent to the implant and the growth of pathogens in cultures of surgical specimens. Despite aggressive antibiotic treatment and debridement of infected surrounding tissues, the standard management of an infected implanted foreign material ultimately includes the removal of that material (1,27–33). However, such an approach might not be applicable in situations where the infected implant is vital to the patient or whenever its removal might result in serious complications and extensive morbidity (27,34).

Muscle flap coverage of exposed or infected foreign material has recently emerged as an invaluable method to salvage foreign implants and grafts (3,27,35–37). Careful scrutiny of the wound, debridement and coverage of the graft with a vascularised muscular flap is appropriate in certain situations (27). The ability of the muscle flap to control infection and decrease bacterial colonisation has been experimentally proven (17) and demonstrated extensively in the clinical practice (38–40). The ability of the muscle flap to increase antibiotic delivery into fibrotic cavities, particularly during the early period after harvesting, has also been demonstrated (41).

Baclofen pump pocket infection with a variety of Gram (–) and Gram (+) organisms, although rare, may be devastating (16). It carries a potential risk of spread along the catheter causing meningitis. With established meningitis secondary to pump pocket infection, pump removal, according to international literature, should be the accepted standard of care (16). However, in the absence of meningitis, pump removal, which is the only reported successful measure to control pump pocket infection, may be unaffordable because of the crippling spasticity that the patient will eventually develop. The high cost of the pump may be another obstacle to its systematic replacement. Although in some countries with well-advanced insurance systems the replacement of an expensive device may not be of immediate big concern, increasing medical costs in general are impacting negatively on the health care systems necessitating

Key Points

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- despite aggressive antibiotic treatment and debridement of infected surrounding tissues, the standard management of an infected implanted foreign material ultimately includes the removal of that material
- muscle flap coverage of exposed or infected foreign material has recently emerged as an invaluable method to salvage foreign implants and grafts
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- the ability of the muscle flap to increase antibiotic delivery into fibrotic cavities, particularly during the early period after harvesting, has also been demonstrated
- baclofen pump pocket infection with a variety of Gram (–) and Gram (+) organisms, although rare, may be devastating; it carries a potential risk of spread along the catheter causing meningitis
- however, in the absence of meningitis, pump removal, which is the only reported successful measure to control pump pocket infection, may be unaffordable because of the crippling spasticity that the patient will eventually develop

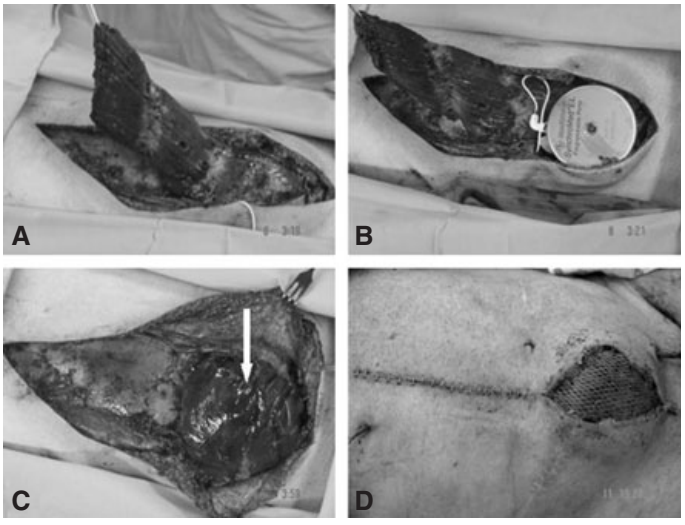

Figure 2. (A) Rectus abdominis muscle elevated on its inferior pedicle with its anterior surface completely exposed. (B) Baclofen pump placed directly over the caudal anterior surface of the muscle. Refill site indicated by arrow. (C) Cephalad portion of the muscle folded over the pump achieving complete coverage. Wound at 5 days with split-thickness skin graft over exposed portion of the muscle flap overlying the refill site.

Key Points

- the paediatric population poses particular challenges because appropriate candidates for intrathecal baclofen therapy are often undernourished and thus have a dearth of soft-tissue mass to cover a subcutaneously implanted pump
- recently, three patients with severe medically intractable spasticity, suffering from infection of the inthrathecally delivering pump have been reported to be successfully treated without pump removal by pump disinfection and intrapocket administration of antibiotics achieving high drug levels locally

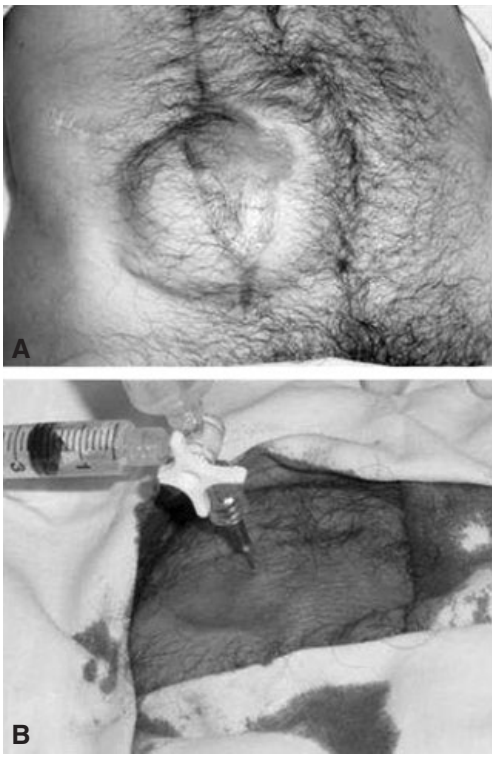

Figure 3. (A) Healed implantation site with no evidence of recurrent infection 3 months after muscle flap coverage. (B) Baclofen pump refilling.

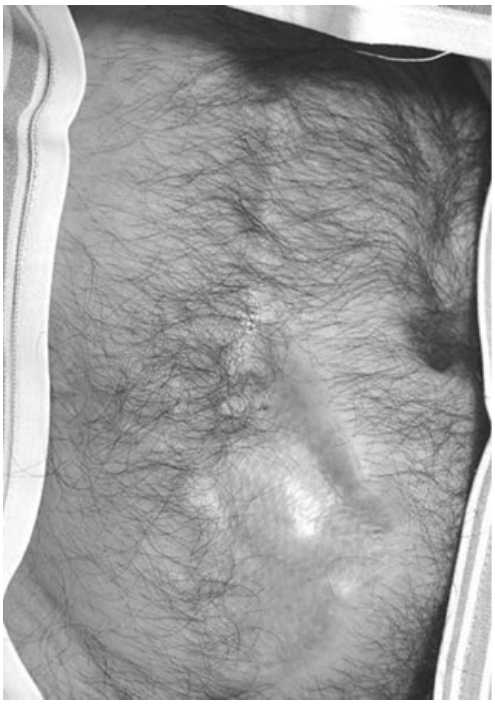

Figure 4. Stable coverage with no recurrent infection 1 year after surgery.

ultimately global cost containment measures and policies.

Recently, Kopell *et al*. (10) suggested a subfascial implantation of the pump in an attempt to prophylactically reduce the risk of infection in children. The paediatric population poses particular challenges because appropriate candidates for intrathecal baclofen therapy are often undernourished and thus have a dearth of soft-tissue mass to cover a subcutaneously implanted pump. The subfascial implantation provides greater soft-tissue coverage, thereby reducing the potential for skin breakdown, and improves the cosmetic appearance of the implantation site. It may also provide a more suitable well-vascularised bed more resistant to bacterial colonisation. This technique, however, does not allow complete coverage of the pump by the muscle, hence, in our opinion, may not be suitable to control established infection.

Based on our previous experience in salvaging infected vascular prosthetic grafts using wrap around muscle flaps to completely engulf the foreign implant (27), the use of an inferiorly based rectus abdominis muscle was the most logical alternative in attempting to salvage a precious and costly prosthetic device. One main concern though was the possible inability to identify the pump's refill site by palpation for later pump filling. Muscle coverage by a split thickness skin graft over the refill site instead of primarily approximating the abdominal skin proved to be highly practical. This, not only, has kept the thickness of tissue coverage over the critical site to a minimum, but as healing progressed and the transposed muscle became atrophic, the stable, thin and pliable tissue coverage proved to be extremely convenient. Another reason not to close the skin primarily over the muscle flap, besides the fact that it would not have added to the vascularity of tissues actually engulfing the metallic device, was our concern that inevitable postoperative oedema would be detrimental to the muscle flap vasculature sandwiched between the hard surface of the pump and an overlying relatively tight skin closure.

Recently, three patients with severe, medically intractable spasticity, suffering from infection of the intrathecally delivering pump have been reported to be successfully treated without pump removal by pump disinfection

and intrapocket administration of antibiotics achieving high drug levels locally (16). In two patients, the surgical wound was reopened and the pump was meticulously cleansed with local antiseptics. Both local (in the pump or the subcutaneous pocket) and systemic antibiotics were also administered. In one patient, a decision was made not to open the abdominal wound, because that particular patient had already had a previous pump removal. The distal catheter was removed from the subdural space in order to avoid the possibility for CNS contamination, and the patient was treated by therapeutic aspirations and intrapocket antibiotic administration. In another report, two infected pumps were salvaged by 'surgical toilette' and peripump injections of antibiotics (42).

What can be concluded from these reports and our present report is that removal should no longer be considered the first treatment option in infections of intrathecally delivering pumps, especially those because of non adherent bacteria, with mild clinical symptomatology. An initial attempt should always be made for conservative treatment (16). In the event of skin breakdown and fistula formation rendering therapeutic aspirations and intrapocket antibiotic administration useless because any injected fluid will leak out and will not be maintained around the pump, the pump may still be salvaged by local pump disinfection, closure of the skin and intrapocket and systemic antibiotics. Although the salvage of few pumps has been reported with this therapy protocol, we believe that wrapping the metallic pump with a well-vascularised muscle flap provides better conditions for cure and clearance of infection. Invariably, the bulk of the muscle wrapped around the implant will allow primary skin closure only under some tension. The avoidance of primary skin closure over the muscle flap, in our opinion, is an important technical detail first to avoid muscle compression and ischaemia because of inevitable oedema in the early postoperative period and second to maintain thin pliable tissues directly over the pump injection site. In case of actual intrareservoir infection, successful treatment with intravenous antibiotics and intrareservoir administration of antibiotics simultaneously with baclofen without pump removal may be attempted (23–25). In most instances, however, meningitis cannot be controlled while the pump is maintained in place (22).

REFERENCES

1 Baumann PA, Cunningham B, Patel NS, Finn HA. *Aspergillus fumigatus* infection in a mega prosthetic total knee arthroplasty: salvage by staged reimplantation with 5-year follow-up. J Arthroplasty 2001;16:498–503.

2 Bowery NG. Baclofen: 10 years. Trends Pharmacol Sci 1982;3:400–3.

3 Gault DT, Quaba A. Is flap cover of exposed metal work worthwhile? A review of 28 cases. Br J Plast Surg 1986;39:505–9.

4 McDowell FH. Treatment of spasticity. Drugs 1981;22:401–8.

5 Albright AL, Barry MJ, Fasick P, Barron W, Shultz B. Continuous intrathecal baclofen infusion for symptomatic generalized dystonia. Neurosurgery 1996; 38:934–9.

6 Armstrong RW, Steinbok P, Cochrane DD, Kube SD, Fife SE, Farrell K. Intrathecally administered baclofen for treatment of children with spasticity of cerebral origin. J Neurosurg 1997; 87:409–14.

7 Boviatsis EJ, Kouyialis AT, Korfias S, Sakas DE. Functional outcome of intrathecal baclofen administration for severe spasticity. Clin Neurol Neurosurg 2005;107:289–95.

8 Coffey RJ, Cahill D, Steers W, Park TS, Ordia J, Meythaler J, Herman R, Shetter AG, Levy R, Gill B *et al.* Intrathecal baclofen for intractable spasticity of spinal origin: results of a long-term multicenter study. J Neurosurg 1993;78:226–32.

9 Gilmartin R, Bruce D, Storrs BB, Abbott R, Krach L, Ward J, Bloom K, Brooks WH, Johnson DL, Madsen JR, McLaughlin, Nadell J. Intrathecal baclofen for management of spastic cerebral palsy: multicenter trial. J Child Neurol 2000;15:71–7.

10 Kopell HB, Sala D, Doyle KW, Feldman DS, Wisoff JH, Weiner HL. Subfascial implantation of baclofen pumps in children: technical note. Neurosurgery 2001;49:753–6.

11 Korenkov AI, Niendorf WR, Darwish N, Glaeser E, Gaab MR. Continuous intrathecal infusion of baclofen in patients with spasticity caused by spinal cord injuries. Neurosurg Rev 2002;25:228–30.

12 Mess SA, Kim S, Davison S, Heckler F. Implantable baclofen pump as an adjuvant in treatment of pressure sores. Ann Plast Surg 2003;51:465–7.

13 Meythaler JM, McCary A, Hadley MN. Prospective assessment of continuous intrathecal infusion of baclofen for spasticity caused by acquired brain injury: a preliminary report. J Neurosurg 1997;87:415–9.

14 Ordia JI, Fisher E, Adamski E, Spatz EL. Chronic intrathecal delivery of baclofen by a programmable pump for the treatment of severe spasticity. J Neurosurg 1996;85:452–7.

15 Stempien L, Tsai T. Intrathecal baclofen pump use for spasticity: a clinical survey. Am J Phys Med Rehabil 2000;79:536–41.

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16 Boviatsis EJ, Kouyialis AT, Boutsikakis I, Korfias S, Sakas DE. Infected CNS infusion pumps. Is there a chance for treatment without removal? Acta Neurochir (Wien) 2004;146:463–7.
17 Gosain A, Chang N, Mathes S, Hunt TK, Vasconez L. A study of the relationship between blood flow and bacterial inoculation in musculocutaneous and fasciocutaneous flaps. Plast Reconstr Surg 1990;86:1152–62.
18 Ismael F, Bleton R, Saleh-Mghir A, Dautrey S, Massias L, Cremieux AC. Teicoplanin-containing cement spacers for treatment of experimental *Staphylococcus aureus* joint prosthesis infection. Antimicrob Agents Chemother 2003; 47:3365–7.
19 Kao LW, Amin Y, Kirk MA, Turner MS. Intrathecal baclofen withdrawal mimicking sepsis. J Emerg Med 2003;24:423–7.
20 Levin A, Sperling K. Complications associated with infusion pumps implanted for spasticity. Stereotact Funct Neurosurg 1995;65:147–51.
21 Bennett MI, Tai YMA, Symonds JM. Staphylococcal meningitis following synchromed intrathecal pump implant: a case report. Pain 1994;56:243–4.
22 Naveira FA, Speight KL, Rauck RL, Carpenter RL. Meningitis after injection of intrathecal baclofen. Anesth Analg 1996;82:1297–9.
23 Galloway A, Falope FZ. *Pseudomonas aeruginosa* infection in an intrathecal baclofen pump: successful treatment with adjunct intra-reservoir gentamicin. Spinal Cord 2000;38:126–8.
24 Samuel M, Finnerty GT, Rudge P. Intrathecal baclofen pump infection treated by adjuvant intrareservoir antibiotic installation. J Neurol Neurosurg Psychiatry 1994;57:1146–7.
25 Zed PJ, Stiver HG, Devonshire V, Jewesson PJ, Marra F. Continuous intrathecal pump infusion of baclofen with antibiotic drugs for treatment of pump-associated meningitis. J Neurosurg 2000;92:347–9.
26 Atiyeh BS, Hayek SN, Skaf GS, Araj AM, Chamoun RB. Salvage of Baclofen pump pocket infection with muscle flap [Letter to the editor]. Plast Reconstr Surg 2004;114:1661–3.
27 Atiyeh BS, Hussein MM, Kayle DI, Nasser AA, Hashim HA. Muscle transposition flap for salvage of exposed peripheral prosthetic vascular grafts. Ann Plast Surg 1998;41:640–5.
28 Bunt TJ. Synthetic graft infections. I. Graft infections. Surgery 1983;93:733–46.
29 Calligaro KD, Delaurentis DA, Veith FG. An overview of the treatment of infected prosthetic vascular grafts. Adv Surg 1996;29:3–16.
30 Fodor L, Ramon Y, Ullmann Y, Eldor L, Peled IJ. Fate of exposed breast implants in augmentation mammoplasty. Ann Plast Surg 2003;50:447–9.
31 Mulcahy JJ. Treatment alternatives for the infected penile implant. Int J Impot Res 2003;15(Suppl. 5):S147–9.
32 Nahabedian MY, Tsangaris T, Momen B, Manson PN. Infectious complications following breast reconstruction with expanders and implants. Plast Reconstr Surg 2003;112:467–76.
33 Perler AB. The case for conservative management of infected vascular prosthetic grafts. Adv Surg 1996;29:17–32.
34 Lesavoy MA, Dubrow TJ, Wackym PA, Eckardt JJ. Muscle flap coverage for exposed endoprostheses. Plast Reconstr Surg 1989;83:90–6.
35 Hutchinson OZ, Oz MC, Ascherman JA. The use of muscle flaps to treat left ventricular assist device infection. Plast Reconstr Surg 2001;107:364–73.
36 Oelbrandt B, Guelinckx PJ, Nevelsteen A. Use of the superior pedicled rectus abdominis flap to cover infected aortic grafts. Br J Plast Surg 2003;56:280–3.
37 Williams IM, Milling MA, Shandall AA. Vascularised muscular flaps and arterial graft infection in the groin. Eur J Vasc Endovasc Surg 2003;25:390–5.
38 Atiyeh BS. Microsurgical composite tissue transfer: an expanding horizon in reconstructive surgery. J Med Liban 1994;42:112–6.
39 Musharrafieh RS, Saghieh SS, Atiyeh BS. Microsurgical free tissue transfer a valuable reconstructive procedure. Review of 75 cases. Int Surg 1999;84:129–34.
40 Musharrafieh RS, Osmani O, Musharafieh U, Saghieh S, Atiyeh B. The efficacy of microsurgical free-tissue transfer in the treatment of chronic osteomyelitis of the leg and foot: review of 22 cases. J Reconstr Microsurg 1999;15:239–44.
41 Russel RC, Graham DR, Feller AM, Zook EG, Mathur A. Experimental evaluation of the antibiotic carrying capacity of a muscle flap into a fibrotic cavity. Plast Reconstr Surg 1988;81:162–70.
42 Sacchettoni SA. Infected CNS infusion pumps. Is there a chance for treatment without removal? Acta Neurochir (Wien) 2004;146:1389.