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Reconstructive

Challenging the Dogma of Dead Space Obliteration With Muscle Flaps in Deep Spinal Surgical Site Infections

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Background: A deep surgical site infection (SSI) after spinal surgery is a serious complication. The defect formed is often a complex 3-dimensional dead space due to tissue loss, frequently containing spinal hardware. Traditionally, obliteration of that dead space is performed with the use of muscle flaps. We challenge this dogma in reconstructive surgery by using the medial dorsal intercostal artery perforator (MDICAP) flap as an alternative in the reconstruction. It adheres to the concept of replacing "like with like," as there are no muscles at the posterior midline.
Methods: A retrospective study was performed of a cohort of 18 patients with deep SSI and a posterior midline defect after spinal surgery who received reconstruction with the MDICAP flap. A review of postoperative imaging with focus on dead space was performed.
Results: All patients had satisfactory functional and aesthetic outcomes. No patients had a recurrent deep SSI during follow-up (average 64 mo, range 3–384 mo). In the 16 patients who had postoperative imaging performed, dead space was not present at the flaps' recipient site.
Conclusions: The MDICAP flap is a good alternative to muscle flaps in reconstructive surgery for complex posterior midline defects caused by a deep SSI after spinal surgery. Postoperative imaging showed no dead space with the use of MDICAP flaps. All patients had an uneventful postoperative course with no recurrent infections. This challenges the dogmata of (1) the need for muscle flaps in such reconstruction and (2) the obligate need for dead space obliteration at the time of operation. *(Plast Reconstr Surg Glob Open 2025;13:e6732; doi: 10.1097/GOX.0000000000006732; Published online 1 May 2025.)*

INTRODUCTION

William S. Halsted[1] wrote in 1890 that "to drain or obliterate with the greatest care of all of the dead spaces of a wound is still an almost universally accepted precept of surgery; and surgeons have a wholesome fear of the presence of blood in wounds." Six years earlier, 2 German surgeons described the use of buried sutures to reduce dead spaces.[2,3] The need for complete obliteration of all dead spaces to prevent postoperative complications is still a widely accepted dogma in surgery.[4] With the knowledge and skills of tissue transfer, the plastic surgeon can play an important role when dead space obliteration is required.[4]

A deep surgical site infection (SSI), defined as a subfascial infection, is a feared complication of spine surgery because it may result in significant morbidity, prolonged hospitalization, poorer long-term outcomes, and high healthcare costs.[5] Treatment of such an SSI can be challenging. The incidence rate of a deep SSI after instrumented spinal fusion has been reported to be 1.5%, with a recurrence rate of 25%, and 1.4 average debridements.[5] Spinal instrumentation may act as an aggregate for biofilm-producing bacteria.[5,6] If infection control is not achieved, instrumentation may have to be removed, leading to significant disability.[6,7] Spinal surgery may result in an area devoid of tissue and bone, especially

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when instrumentation is required or a laminectomy is performed.[7,8] Managing the resulting dead space has been described as a critical step in eradicating deep SSI and to prevent a new nidus for seroma or hematoma that may become infected.[9,10]

The unavoidable use of muscle flaps to obliterate dead spaces is another dogma in surgery.[11–14] Even though there is substantial evidence to support this dogma in spine surgery, the muscles used are also important to ensure postural stability.[15] Avoiding their use would be a major advantage. Perforator flaps are associated with minimal donor site morbidity.[16] However, perforator flaps are not commonly used to obliterate dead spaces in spine surgery.[10] Perforator flaps can be relatively inelastic due to variation in the thickness of the patient's adipose layer, and whether deep fascia or skin is included in the flap.[17] In cases of a deep cavity, muscles have been described as superior regarding flexibility and malleability, allowing it to fill the defect and cover irregularities in the wound bed.[17] Another reason that perforator flaps are less commonly used may be the requirement of microsurgical skills and knowledge of the perfusion area of that perforator.[18]

The purpose of this study was to challenge 2 central dogmata in reconstructive surgery: first, that muscle flaps are needed to obliterate dead space in reconstructive surgery for complex posterior midline defects after spine surgery and secondly, the need for complete dead space obliteration at the time of reconstruction. Therefore, we analyzed our results with the use of the medial dorsal intercostal artery perforator (MDICAP) flap in patients with a deep SSI with or without exposed instrumentation following spine surgery, with special emphasis on postoperative imaging and the presence of dead space.

Takeaways

Question: Are muscle flaps needed for dead space obliteration in deep surgical site infections after spinal surgery?

Findings: This retrospective study of 18 patients showed that the sensate medial dorsal intercostal artery perforator flap is a good alternative in the reconstruction of complex 3-dimensional wounds, caused by deep surgical site infection after spinal surgery without the need for hardware removal.

Meaning: Our study indicates that the dogma of using muscle flaps to obliterate dead space in this clinical setting was successfully challenged by using a midline-based perforator flap instead.

MATERIAL AND METHODS

A retrospective chart review was performed of all patients who had been consecutively treated for posterior midline defects with deep SSI after spinal surgery with a MDICAP flap at our tertiary hospital by the same plastic surgeon after they had given their informed consent. The study was approved by the in-house data protection office and compliant with the Helsinki Guidelines for Ethical Principles for Medical Research Involving Human Subjects. The collected data comprised patient demographics (age and sex); indication for operation; operation type; spine level; microbiological agent; defect size; flap size; use of postoperative vacuum-assisted closure (VAC) (KCI Medical, San Antonio, TX); follow-up (months); clinical results; and analysis of medical imaging, including computed tomography (CT) and magnetic resonance imaging (MRI). The postoperative CT and MRI of the reconstructed area were reviewed. If present, imaging performed at a later stage was reviewed.

Surgical Procedure

Following debridement, antibiotic treatment was started based on bacteriological samples taken from the wound bed before debridement and adjusted if bone samples taken during debridement indicated a different bacteriological diagnosis. After debridement, negative pressure wound treatment (NPWT) using VAC was started for 1 week, except for the patient with a metastasis in Th12 vertebra. Antibiotic treatment was given following advice from the Department of Infectious Diseases. Harvest of the sensate MDICAP flap was standardized as previously described.[19,20] The length and width of the defect were measured at skin and subcutaneous level. A MDICAP near the defect was located with a hand-held Doppler (8 MHz, Multi Dopplex II, Huntleigh Healthcare, Cardiff, UK). A boat-shaped flap was designed along the axis of the intercostal artery. The flap was beveled out at subcutaneous level and elevated from lateral to medial at subfascial level until the perforator complex, consisting of the perforator artery and its accompanying vein(s) and cutaneous nerve, was identified. In 2 cases, the flap was deepithelialized at the distal part of the flap to fill the wound cavity beneath the distal end of the old, healed suture line from the first surgery. The flap was sutured into the defect over a suction drain. The donor site was closed over a suction drain. If available, postoperative wound closure stabilization was performed with the VAC system for 1 week. Drains were removed when they produced less than 30 mL/d.

RESULTS

Eight women and 10 men (average age of 54.6 y [14–78 y]) were included. Demographics are shown in Table 1. Ten patients were smokers, of whom 2 were on immunosuppressants. All flaps survived, although 1 patient, a smoker, required excision of the distal necrotic tip followed by direct closure. At follow-up (average 64 mo [3–384 mo]), none reported functional loss or any discomfort in the donor area. In all patients, except for the lumbar area of the patient with meningomyelocele, Semmes-Weinstein monofilament testing showed that protective sensibility was obtained in the reconstructed area with a threshold of 3.61. All patients achieved infection control, had an uneventful postoperative course, and obtained stable wound coverage. Of the 18 patients, 13 had defects containing spinal hardware. None had to have their spinal hardware removed.

Table 1. Patient Demographics (Age, Sex), Indication for Initial Operation, Type of Operation, Spine Level, Microbiological Agent, Defect Size, Flap Size, Follow-up (Months), and Flap Coverage

	Age (y)	Sex (M/F)	Indication for Initial Operation	Operation Performed	Spine Level	Microbiological Agent	Hardware (Yes/No)	Defect Size (cm)	Flap Size (cm)	Follow-up (mo)	Clinical Outcome
1	52	M	Syringomyelia	Laminectomy, duroplasty	C4-T2	*Enterococcus fecalis*	No	11x2.5	13 × 4	384	Good
2	61	M	Trauma/fracture	Fixation	T1-T5	*Staphylococcus aureus*	Yes	13 × 2	17 × 5	81	Good
3	71	F	Trauma/fracture	Fixation	C5-T2	No growth of bacteria	Yes	11 × 6	19 × 7	76	Good
4	57	M	Thoracic kyphhosis	Laminectomy and fixation	C4-T6	*S. aureus*	Yes	15 × 4	21 × 6	64	Good
5	47	F	Metastasis Th12	Laminectomy, fixation	T10-L2	*S. aureus*	Yes	6 × 3	11 × 4	7	Good
6	14	M	Myelomeningocelce, scoliosis	Fixation	C6-T2 T5-T12	*S. aureus*	Yes	6 × 4,8 × 4,24 × 4	11 × 4,11 × 7,24 × 7	62	Good
7	46	F	Trauma/fracture	Fixation	T11-L3	*S. aureus*	Yes	15 × 4	15 × 4	59	Good
8	43	F	Trauma/fracture	Fixation	L1-L5	*S. aureus*	Yes	12 × 4.5	13 × 5	64	Good
9	62	M	AxSpa/fracture	Fixation	C5-T3	*S. aureus*	Yes	6 × 4	12 × 4	53	Good
10	32	M	Traumatic syringomyelia	Decompression, fenestration, laminectomy	T4-T8	*S. aureus*	Yes	8 × 6	10 × 5	10	Good
11	69	M	Spinal stenosis	Laminectomy	T2-T6	*S. aureus*	No	16 × 6	18 × 6	83	Good
12	73	F	Cervical myelopathy due to spinal stenosis	Laminectomy	C4-C7	*Corynebacterium* species, *S. aureus*	No	7 × 3	10 × 3	19	Good
13	56	M	Epidural abscess/ osteomyelitis	Columnar reconstruction after corpectomy, fixation	C2-T1	*Staphylococcus epidermidis*	Yes	15 × 4	22 × 5	74	Good
14	60	M	Spinal stenosis	Laminectomy	T12-L3	*S. aureus*	No	8 × 4	10 × 5	43	Good
15	78	F	Cervical myelopathy due to spinal stenosis	Laminectomy and fixation	C3-C7	*S. epidermidis*	Yes	7 × 5	11 × 5	24	Good
16	26	F	Intradural tumor	Laminectomy	L3-L5	MRSA, enterobacter cloacae	No	7 × 6	9 × 6	7	Good
17	75	F	Cervical myelopathy due to spinal stenosis	Laminectomy and fixation	C2/C5	*S. aureus*	Yes	7 × 4	10 × 5	27	Good
18	60	M	Cervical myelopathy due to spinal stenosis	Laminectomy	C3/C7	*S. aureus, Cutibacterium acnes*	Yes	10 × 5	12 × 5	3	Good

A good clinical outcome was defined as no recurrent infection, and definite closure of the defect.
F, female; M, male; MRSA, methicilline-resistant Staphylococcus aureus.

Table 2 shows imaging features of the reconstructed area with specific emphasis on dead space. Of the 18 patients, 16 had postoperative imaging performed. One patient had imaging performed with an older CT scanner, leaving the images uninterpretable due to metal artifacts.

DISCUSSION

The study findings are novel and inventive in several ways. Satisfactory functional and acceptable aesthetic outcomes were obtained using the MDICAP flap in the reconstruction of posterior midline defects with a deep SSI with significant tissue loss and with or without exposed hardware after spinal surgery.

Reconstructive surgery is aimed at restoring form and function following a congenital or acquired defect.[4] Traditionally, decision-making has been aided by the reconstructive ladder.[11,12,21–23] Its sole purpose is guiding the surgeon toward the simplest procedure that obtains wound closure. It does not specifically comment on preserving form and function. This reasoning is becoming increasingly obsolete with the expanded knowledge of vascular anatomy and tissue perfusion, as well as the increasing availability of microsurgical techniques.[22,24] A step in the reconstructive ladder, and a common approach to flap-based reconstruction, is using muscle flaps.[10] These flaps are the workhorses of posterior trunk reconstruction.[10,12,13] Due to loss of muscle function as well as their large size, they are associated with significant donor site morbidity.[17] Muscle flaps fill dead spaces with well-vascularized tissue that promotes wound healing and inhibits bacterial growth through the delivery of oxygen, antibiotics, and immune cells while removing free radicals.[10,13,25] This is especially important in case of a

Table 2. Findings on Medical Imaging (CT/MRI)

	Age (y)	Sex (M/F)	Indication for Initial Operation	Operation Performed	MRI	CT
1	52	M	Syringomyelia	Laminectomy, duroplasty	No dead space, sunken flap	No dead space, sunken flap
2	61	M	Trauma/fracture	Fixation with plate and screws	No dead space, sunken flap	No dead space, sunken flap
3	71	F	Trauma/fracture	Fixation with plate and screws	No imaging	No dead space, flap just below subcutaneous tissue
4	57	M	Thoracic kyphhosis	Laminectomy and fixation	No imaging	No imaging
5	47	F	Metastasis Th12	Laminectomy, fixation	No imaging	Too many artifacts to interpret
6	14	M	Meningomyelocele, scoliosis	Fixation	No dead space, sunken flap	No dead space, sunken flap
7	46	F	Trauma/fracture	Fixation	No dead space, sunken flap	No imaging
8	43	F	Trauma/fracture	Fixation	No imaging	No dead space, sunken flap
9	62	M	Axial spondyloartritis/fracture	Fixation	No imaging	No imaging
10	32	M	Trumatic syringomyelia	Decompression, fenestration, laminectomy	No dead space, flap in line with subcutaneous tissue	No dead space, sunken flap
11	69	M	Spinal stenosis	Laminectomy	No dead space, flap in line with subcutaneous tissue	No dead space, flap in line with subcutaneous tissue
12	73	F	Cervical myelopathy due to spinal stenosis	Laminectomy	No dead space, flap in line with subcutaneous tissue	No dead space, sunken flap
13	56	M	Epidural abscess/osteomyelitis	Columnar reconstruction after corpectomy, fixation	No dead space, flap in line with subcutaneous tissue	No dead space, sunken flap
14	60	M	Spinal stenosis	Laminectomy	No dead space, sunken flap	No imaging
15	78	F	Cervical myelopathy due to spinal stenosis	Laminectomy and fixation	No dead space, sunken flap	No dead space, sunken flap
16	26	F	Intradural tumor	Laminectomy	Flap in line with subcutaneous tissue	No imaging
17	75	F	Cervical myelopathy due to spinal stenosis	Laminectomy and fixation	No dead space, sunken flap	No imaging
18	60	M	Cervical myelopathy due to spinal stenosis	Laminectomy	No imaging	No imaging

F, female; M, male.

deep SSI following spinal surgery.[26] Ramasastry et al[25] outlined key principles for achieving satisfactory outcomes in this challenging patient group (Fig. 1). All patients in our study were treated in accordance with their recommendations. Although Ramasastry et al highlight the importance of obliteration of dead space with well-vascularized tissue, they do not mention how this should be attained.[25]

Since the publication by Koshima and Soeda[27] in 1989, perforator flaps have grown in popularity and have largely replaced muscle flaps in several reconstructive procedures.[23,24] Guerra et al showed that muscle and perforator flaps have an equal ability to provide well-vascularized tissue and sufficient oxygen saturation to the recipient site.[10,13,28,29] Their results are supported by other clinical studies.[30] Traditionally, perforator flaps have not been considered for posterior trunk reconstruction in the setting of deep SSI with or without exposed spinal hardware and significant tissue loss.[10,19,25] It was long thought that in these situations muscle flaps were necessary to obtain control over the deep SSI because these flaps are well-vascularized and obliterate dead space.[10,25,31] In that respect, our study is unique, as this is, to our knowledge, the first time that an objective method was used to evaluate the existence of a dead space after the use of a perforator flap. In fact, neither were we able to find such a study in which a muscle flap was used.

Principles of posterior trunk reconstruction

1. Control of infection with appropriate systemic antibiotic agents
2. Local wound care
3. Extensive debridement of all devitalized tissue
4. Re-establishment or maintenance of skeletal stability
5. Preservation of neural function
6. Obliteration of dead space with well-vascularized tissue
7. Early definitive coverage of the defect to minimize infective complications

Fig. 1. Principles of posterior trunk reconstruction, as formulated by Ramasastry et al.[25]

In 2007, Minabe and Harii[32] described for the first time a perforator flap based upon the dorsal intercostal artery, although they do not describe if flaps were based on the medial or lateral branches of dorsal intercostal arteries. Cormack and Lamberty,[33] as well as others, showed that the medial branch perforators of the dorsal intercostal artery always lie close to the midline along the cervical and thoracic column.[19,20] Angrigiani et al[34] reported that these perforator flaps also could be based on a cross-midline perforator. The latest and largest study to date on posterior trunk reconstruction with perforator flaps by Hernekamp et al[35] showed excellent results. Our findings show that the sensate MCICAP flap is also a viable option for the treatment of deep SSI after spinal surgery with dead space and with or without exposed hardware.

When discussing instrumentation, one must mention the aspect of hardware removal to facilitate wound healing.[7,26] This is a divisive subject.[36–38] Some authors deem hardware removal necessary to gain infection control, despite that removal of hardware is associated with lesser functional results.[26,37] None of the 13 patients in our study with spinal hardware required removal to achieve infection control. This shows that the MDICAP flap can contribute to eradicate the deep SSI. Furthermore, the MDICAP flap provided adequate padding over the instrumentation, meaning that the bulk of a muscle flap is not needed.

All patients received NPWT after debridement. NPWT promotes wound healing, as it removes edema, prevents seroma formation, and stimulates angiogenesis and formation of granulation tissue.[39] We postulate that NPWT provides a more viable wound bed for the flap and reduces the wound's 3-dimensional complexity.

During wound closure, the wound cavity was not completely obliterated by the MDICAP flap, leaving dead space underneath the perforator flap (Figs. 2–7). In 8 of 18 patients, VAC was used for postoperative wound closure stabilization. We postulate that VAC presses the flap into the wound cavity as the system exerts a force on the surrounding tissue toward the posterior midline.[40,41] However, in the 10 patients who did not have VAC for postoperative wound stabilization, we also observed "sunken flaps" on clinical examination during follow-up, as well as on imaging, in which the flap was visualized at a lower level than the surrounding skin (Figs. 8 and 9).

Imaging of dead space has hardly been discussed in the literature. Two articles discuss the importance of preoperative mapping and planning of the area undergoing reconstruction, so as to find a muscle flap with suitable volume for dead space obliteration.[42,43] To our knowledge, no articles discuss the postoperative imaging of dead spaces. All but 2 patients had imaging of the reconstructed area performed.

As imaging was not protocolled, patients had imaging with only CT, only MRI, both, or none. MRI with standard sequences, especially T2 short tau inversion recovery, proved to be the most useful modality when examining images for dead space, due to its excellent ability to separate fat and fluid with acceptable artifacts from spinal hardware. When performed on a modern scanner, CT visualized soft tissue and bony tissue with only moderate metal artifacts, although with reduced ability to separate fat and fluid as compared with MRI (Figs. 10–13). Even though some of the patients had a small fluid-filled dead space when imaging was performed directly after the

Fig. 2. MDICAP flap marked on the skin before dissection and harvest (patient 13).

Fig. 3. Intraoperative view showing the complex 3-dimensional wound cavity in patient 13. Spinal hardware is present lateral to the spine on each side.

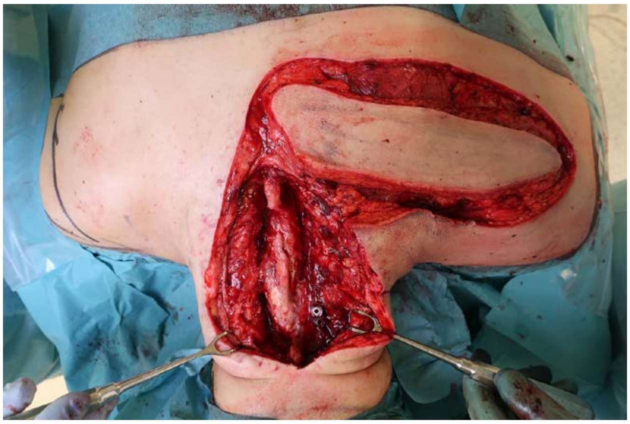

Fig. 4. The MDICAP flap has been dissected in patient 13. Picture taken before transposition.

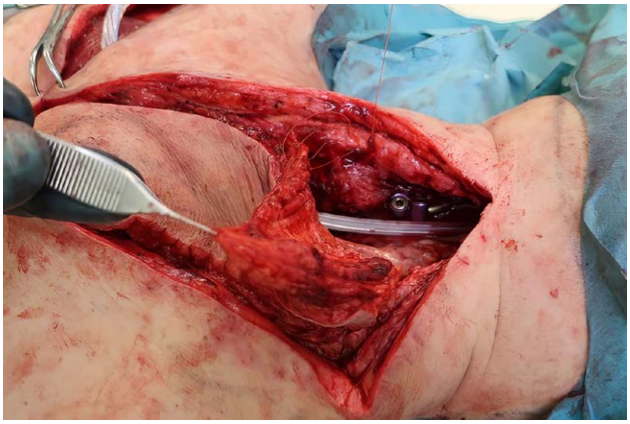

Fig. 5. Flap to be sutured over suction drain in patient 13. The dead space is not obliterated by the thin flap.

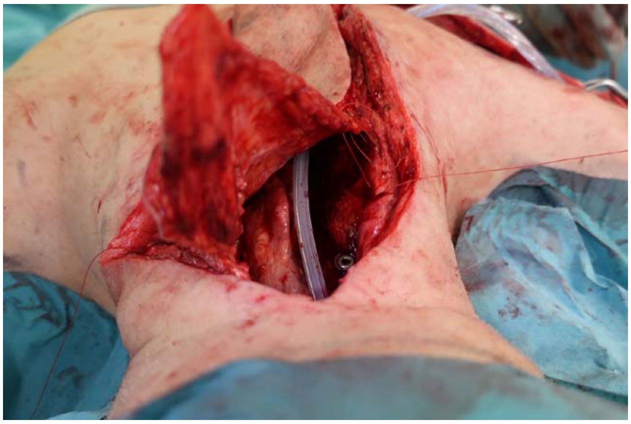

Fig. 6. This figure shows clearly that the perforator flap does not obliterate dead space in patient 13.

Fig. 7. Patient 13 directly after removing surgical drapes postoperatively. The MDICAP flap is stapled in line with other subcutaneous tissue. It is not "sunken"; therefore, dead space is present.

Fig. 8. Digital photography showing clinical result at follow-up consultation of patient 13, who did not receive postoperative wound stabilization with the VAC system.

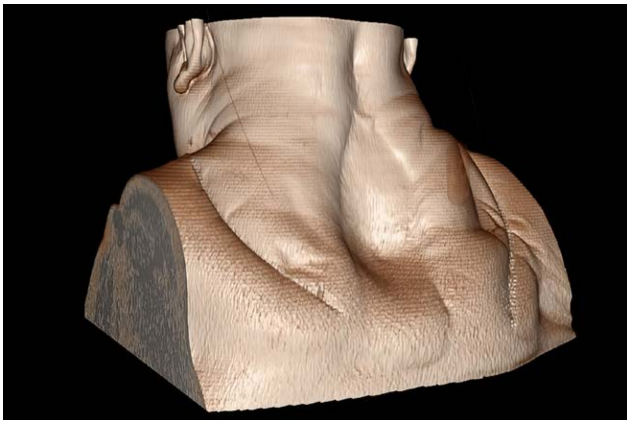

Fig. 9. Three-dimensional reconstruction of CT scan depicting the flap "sunken" into the wound cavity in patient 13, in line with clinical findings seen.

operation, none had discernable dead space when examined at a later stage.

We challenge, therefore, the obligate use of muscle flaps for dead space obliteration, as well as the obligate need for dead space obliteration at the end of the operation. The excellent results that were obtained with the use of muscle flaps in the treatment of deep SSI may have resulted in a hesitation to challenge this. The resistance of

Fig. 10. CT scan of patient 13 performed 4 years postoperatively. The scan is showing the reconstructed area in the sagittal plane. The flap is seen posterior to the osteosynthesis material and fibula graft. No dead space could be detected on the CT scan, which showed only minimal artifacts from hardware.

Fig. 12. Sagittal T2 short tau inversion recovery sequence MRI from patient 13 3 years after the operation. In the sagittal plane, no dead space can be seen. There are minimal artifacts from spinal hardware.

Fig. 11. CT scan showing the reconstructed area in the axial plane in patient 13. The flap is sunken in and appears to be settled deeper than the surrounding subcutaneous tissue in the wound cavity. There is no dead space, and minimal artifacts from hardware.

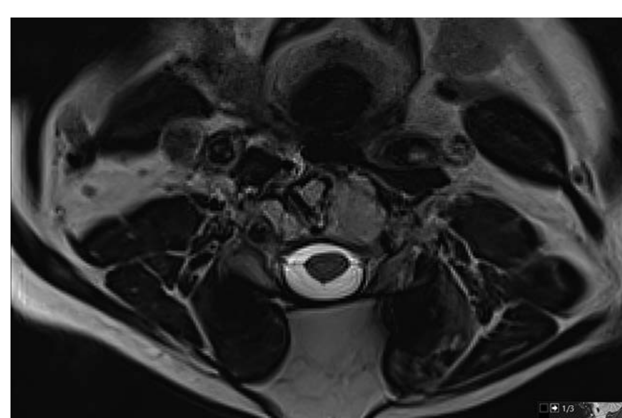

Fig. 13. Axial T2-weighted MRI image from patient 13. There are no signs of dead space, and the flap is filling the wound cavity.

muscles to bacterial infection was highlighted in publications in the mid-80s, but it was not until 2006 that Guerra et al[29] showed that perforator flaps had a comparable ability to resist infection.[44] They found similar perfusion indexes for muscle flaps and perforator flaps, indicating that both flaps have similar ability to deliver antibiotics, nutrients, and immunological activity at the infection site.[29]

The MDICAP flap seems to have several advantages compared with the historically favored muscle flap. MDICAP flap design and harvesting is simple due to consistent anatomy.[20,32] The flap can be harvested as a sensate flap, which is a great advantage when reconstructing spinal wounds.[19] This reduces the risk of pressure injuries.[19] Interestingly, patients reported that, although pressure with the monofilament was exerted on the skin of the flap at the recipient site, it felt as if it was at the donor site, confirming that the dermatome followed the transposed flap.

Perforator flaps cause also less donor site morbidity.[30] In the case of posterior trunk reconstruction, the muscles most used are the erector spinae and latissimus dorsi muscles, which are important for spinal stability.[10,13,15,45]

Most patients undergoing posterior trunk reconstruction as a salvage procedure have underlying neurological disorders, leading to varying degrees of reduced muscle function.[13] Therefore, maintaining muscle integrity and adequate truncal support is of great importance. This can partly be ensured through preservation of the erector spinae and latissimus dorsi muscles when considering surgical options. In cases of multilevel fixation, the erector spinae muscles no longer serve their purpose; however, this is not always the case.[10] Moreover, experience from breast reconstruction with the latissimus dorsi flap shows that transposition could be associated with developing scoliosis.[45]

Tension-free wound closure is a goal in all reconstructive procedures.[4] Current trends for spinal surgery show that older patients with more and increasingly severe medical comorbidities are candidates for intervention compared with earlier.[46] Wound healing may be impaired in this group. We postulate that wound healing and recovery are facilitated in patients reconstructed with a perforator flap in comparison to a muscle flap due to less tissue volume and less donor-site morbidity. In addition, tension-free would closure is easily obtained, which promotes wound healing and therewith reduces the risk for wound rupture.[47]

It was long thought that the bulk of a muscle flap was required for adequate padding of the hardware to minimize the risk of overlying skin necrosis.[10,48] Our findings show that the MDICAP flap provided adequate padding and stable wound coverage. Additionally, the perforator flap can be deepithelialized and buried to fill a part of the wound cavity followed by midline wound closure, providing added coverage over hardware if necessary.[20]

The use of the MDICAP flap for closure of posterior midline defect adheres to another reconstructive principle of replacing “like with like” because there are no muscles present the posterior midline[4,47,49]

Some institutions have used the prophylactic use of a muscle flap for wound closure in high-risk patients, leading to reduced infection rates.[12,13] To our knowledge, there are no publications that report on the prophylactic use of a perforator flap in this patient group. Given the relative ease of harvesting a MDICAP flap and its associated minimal donor-site morbidity, prophylactic use of this flap should be considered in high-risk patients.

The limitations of this study are the limited number of patients, its retrospective character, and that we did not perform a randomized control study in which the perforator flap technique was compared with the muscle flap technique. Because of the small study size, our results are indicative and should be interpreted within the context of this limitation. On the other hand, our patients are characterized by having complex midline defects after spine surgery with deep SSI, with or without exposed hardware. Treatment with irrigation and debridement as well as treatment with a negative pressure device did not permit wound closure. Traditionally, muscle flaps would have been the preferred treatment for closure of these defects.

Based on the results from our study, we conclude that the sensate MDICAP flap is a reliable alternative to muscle flaps in the treatment of complex defects after spine surgery associated with SSIs, along the entire length of the posterior column. The use of the VAC system following debridement and before reconstruction, as well as in the direct postoperative period for stabilization may have contributed to the excellent results that were obtained. The applied technique, as reported in our study, reduces length of hospital stay, need for rehabilitation, and risk for reoperation and reinfection, hence reducing health care costs.

CONCLUSIONS

The MDICAP flap is a valuable alternative to the use of a muscle flap for reconstruction of posterior midline defects caused by deep SSI after spinal surgery, with or without exposed hardware. This challenges the dogmata (1) that dead space must be obliterated with muscle and (2) that dead space must be completely obliterated at the end of the operation. Medical imaging, especially MRI, can be useful in evaluating dead space after reconstructive procedures. We believe our study highlights the importance of treatment of infection based on proper microbiological diagnostics, debridement, and the use of vacuum assisted closure, as well as providing well-vascularized tissue to the wound cavity, ensuring delivery of antibiotics. This can be accomplished with the use of the MDICAP flap and not necessarily a muscle flap.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Written informed consent was obtained from the patients for publication of the images.

DECLARATION OF HELSINKI

The work described has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).

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