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Evaluation of spinal instrumentation following organ transplantation: A retrospective cohort study

Organ nakli sonrası spinal enstrumantasyon sonuçları: Retrospektif kohort çalışma

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Abstract

Aim: Improvements in transplantation medicine and surgery, anesthesiology, and postoperative care paved the way for successful procedures for transplant patients. The aim of the present study is to describe the results of surgical correction for spinal deformities in patients who underwent several types of organ transplantation.

Methods: The study group consisted of ten patients with a history of organ transplantation who require spinal surgery with different etiologies. Seven (70%), two (20%) and one (10%) patient had lung, liver, and lung transplantations, respectively. The etiology for spinal surgery was spinal stenosis in six (60%), vertebra fracture in three (30%), and vertebral metastasis in one (10%) patient. Pre-intra- and postoperative radiological, clinical, and functional outcomes were noted.

Results: The mean age of the patients was 57.1 (8.9) years, ranging between 38-62 years. Six of the patients were male, and four were female. Surgery time following the transplant surgery was 15.6 (2.1) months. The blood requirement in the operating room was 5.6 (0.8) units of erythrocyte suspension. Hospital length of stay was 8.5 (5.6) days following the spinal instrumentation surgery. Two patients had mild complications in the postoperative period. The preoperative VAS score significantly decreased from 6.4 (0.8) to 3.1 (1.6) after the surgery (P<0.001).

Conclusions: Posterior spinal instrumentation on transplanted patients can be an effective treatment which improves the life quality of the patients. A multidisciplinary approach with an experienced team is highly required.

Keywords: Organ transplantation, Hepatocellular carcinoma, Spinal surgery, Spine metastasis, Instrumentation

Öz

Amaç: Organ nakli cerrahisi, anestezi ve postoperatif bakımdaki gelişmeler transplant hastalarında ek cerrahi girişimlerin de yapılabilmesinin önünü açmıştır. Bu çalışmanın amacı farklı organ nakilli hastalarda omurga cerrahisinin sonuçlarını incelemektir.

Yöntemler: Farklı etiyolojilerle omurga cerrahisi uygulanan 10 transplant hastası çalışmaya dahil edildi. Yedi hasta (%70) böbrek nakli, 2 hasta (%20) karaciğer ve 1 hasta (%10) akciğer nakli olmuştu. Hastaların 6'sı (%60) spinal stenoz, 3'ü (%30) vertebra kırığı ve 1'i (%10) vertebra metastazı sebebi ile omurga cerrahisi geçirmişti. Hastaların ameliyat öncesi ve sonrası radyolojik, klinik ve fonksiyonel durumları ve ağrı skorlamaları incelendi. Ameliyat süreleri, kan transfüzyon ihtiyacı ve hastanede kalış zamanları not edildi.

Bulgular: Hastaların yaş aralığı 38-62 yıl ve yaş ortalaması 57,1 (8,9) idi. Hastaların altısı erkek, dördü kadındı. Transplant cerrahisinden omurga ameliyatına kadar geçen süre ortalama 15,6 (2,1) ay bulundu. Hastalara ameliyat esnasında ortalama 5,6 (0,8) ünite eritrosit süspansiyonu verildi. Hastanede kalış süresi ortalama 8,5 (5,6) gündü. İki hastada ameliyat sonrası minör komplikasyon gelişti. Hastaların ameliyat öncesi 6,4 (0,8) olan VAS ağrı skorlarının 3,1'e (1,6) düştüğü gözlendi (P<0.001).

Sonuç: Posterior spinal enstrumantasyon, transplant hastalarında da yaşam kalitesini arttırmada etkili bir yöntemdir. Tecrübeli bir ekip ve multidispliner yaklaşım şarttır.

Anahtar kelimeler: Organ nakli, Hepatosellüler karsinom, Omurga cerrahisi, Omurga metastazı, Enstrumantasyon

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Introduction

Organ transplantation has become the essential treatment modality for medically suitable patients with organ failure. Improvements in transplantation medicine and surgery, anesthesiology, and postoperative care have led to increased success ratios of different procedures on transplant patients [1,2].

Multiple factors contribute to the pathogenesis of a spinal defect on this patient group, including organ metastasis, prolonged use of medications, restriction in movement and immobilization, the effect of the systemic disease on bone morphology [3,4]. Life quality of these patients is impaired due to the spinal defect, and correction of the deformity is crucial, especially for severe cases.

There are a limited number of articles on spinal instrumentation surgery on transplant patients. The aim of the present study is to describe the results of surgical correction for spinal deformities in transplant patients who underwent different types of organ transplantation.

Materials and methods

Following approval from the Ethical Committee of Istanbul Yeni Yuzyil University (04.03.2019, number 2019/3), records of organ transplanted patients who underwent spinal instrumentation were retrospectively evaluated. Informed consent was obtained from all patients. The study group consisted of ten patients with a history of organ transplantation who required spinal surgery with different etiologies. Seven, one and two patients had kidney, lung and liver transplantations, respectively. The etiology for spinal surgery was spinal stenosis in six, vertebra fracture in three, and vertebral metastasis in one patient. Of those, only one patient with previous kidney transplantation had congenital scoliosis. Four patients in the kidney transplantation group had stenosis, and two suffered from fractures. Among those who underwent liver transplantation, one patient had metastatic bone disease (Figure 1), and one had stenosis due to immunosuppressant therapy. One patient with lung transplantation had vertebral fractures.

All patients underwent operations through the posterior surgical approach. Polyaxial pedicle screws were placed under fluoroscopic control. Laminectomy and partial facetectomy was performed for decompression in patients with spinal stenosis. The solitary case with metastatic lesion required *en bloc* laminectomy, dural decompression, right pediculectomy, and marginal posterior corpus resection following posterior instrumentation (Figure 2).

The duration between the transplantation and instrumentation surgery, intraoperative blood products, postoperative follow-up data were collected and recorded. Postoperative radiological, clinical, and functional outcomes were also noted. Patients' VAS for pain at 1 month after surgery were recorded and compared to baseline values.

Statistical analysis

The results were presented as mean (standard deviation) for continuous variables. Categorical variables were described as frequency and percentage. Continuous variables were compared using paired samples t-test. A *P*-value <0.05 was considered as significant. All statistical analyses were performed with IBM SPSS ver. 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.).

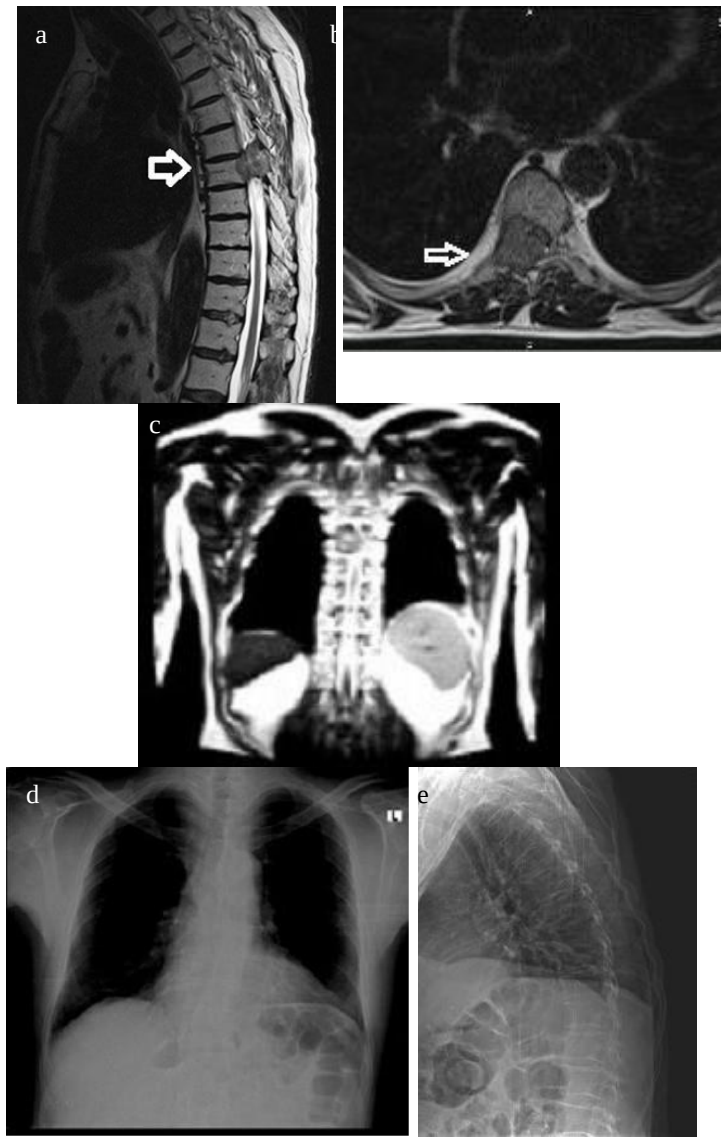

Figure 1: Preoperative sagittal views of T1-weighted (a), axial (b), and coronal (c) magnetic resonance images. Anteroposterior (d) and lateral (e) X-rays show the T7 metastasis (arrow)

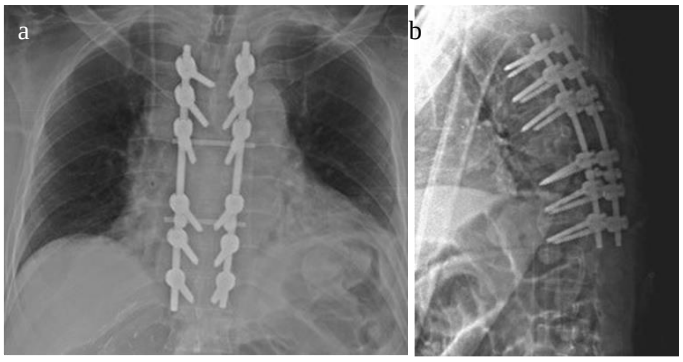

Figure 2: Postoperative anteroposterior (a) and lateral (b) X-rays after posterior wide resection and spinal instrumentation for T7 metastasis

Results

The mean age of the patients was 57.1 (8.9) years ranging between 38-62 years. Six of the patients were male, and four were female. Six patients had moderate, and four patients had mild neurological deficits. All patients had a history of pain that non-prescription analgesics could not relieve.

Surgery time following the transplant was 15.6 (2.1) months. The blood requirement in the operating room was 5.6 (0.8) units of erythrocyte suspension. Hospital length of stay was 8.5 (5.6) days following the spinal instrumentation surgery. All

patients were taking various doses of the immunosuppressive agent, Tacrolimus, since their transplantation surgery. Four cases were previous smokers, and none used alcohol.

All patients achieved ambulatory status following surgery. The preoperative VAS score significantly decreased from 6.4 (0.8) to 3.1 (1.6) after the surgery (P<0.001). Two patients returned to work, and the remaining cases could perform daily activities at home. There were no implant failures, screw loosening or loss of reduction during the follow-up period. Sagittal and coronal alignment was within normal limits in 9 cases.

Two patients had complications in the postoperative period. A cerebrospinal leak in one patient was repaired by suturing the dura mater and augmenting with fibrin glue. Superficial infection of another improved with antibiotics and regular dressing. No patients developed nosocomial infection. There were no graft rejections or transplant related complications during the study period. At month-10, positron emission tomography (PET)-CT of the patient with hepatocellular carcinoma showed a 39 mm left sacroiliac joint metastatic lesion that was treated by radiotherapy (Figure 3). The patient developed no further symptoms or recurrence and was able to perform all daily activities at the 21st month. All patients were alive as of 2019.

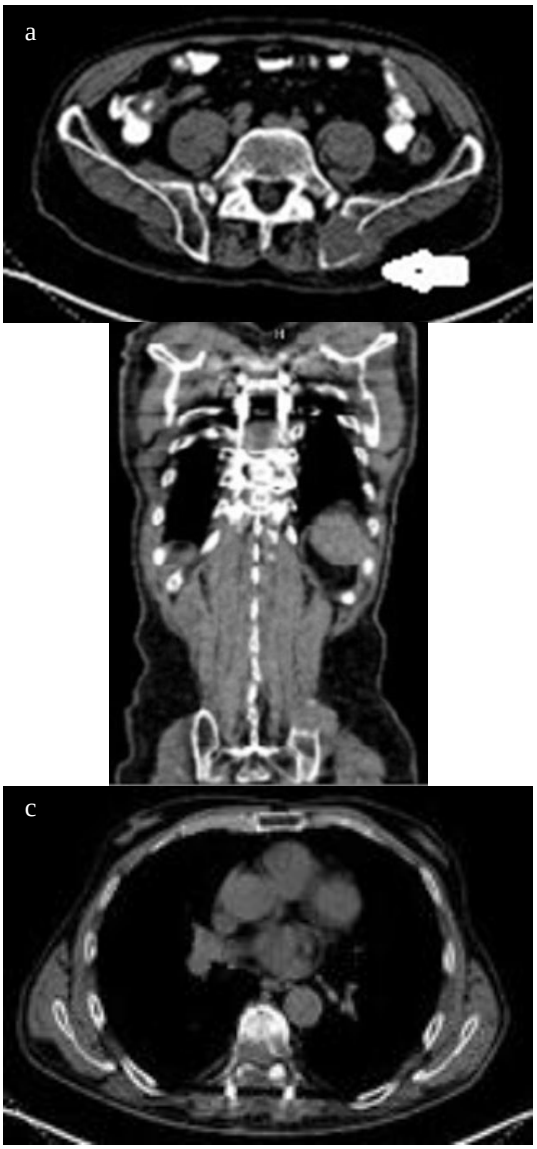

Figure 3: PET-CT images at month-20 after surgery. Note the 39 mm metastatic lesion at the left sacroiliac joint (arrow; a, b) and the intact T7 vertebra (c)

Discussion

With the developments in the field of spinal surgery, the number of transplanted patients undergoing instrumentation and fusion surgery increase gradually. There are several reports demonstrating efficient outcomes in this patient group for the hip or knee replacement surgery [5-7]. Additionally, the establishment of minimally invasive surgical techniques and regional blocks especially in patients with organ failure increases the success rate of surgeries in this specific patient group [8,9]. Our results present additional data for the literature stating that transplanted subjects might be treated for spinal fusion and instrumentation without major side effects.

Spinal problems requiring surgery in patients after organ transplantation might be observed because of various conditions. The need for spinal surgery was vertebra metastasis in one patient who underwent liver transplantation due to hepatocellular carcinoma. Three patients had spinal fractures due to prolonged use of immunosuppressant and corticosteroids, and their detrimental effects on the bone structure. Besides these, patients with renal transplantations might have a syndrome, and vertebra abnormalities might be a component of their syndrome [10,11]. We did not detect a growth abnormality in any of the cases, and all patients are adults with a moderate level of skeletal growth. We also did not observe a visible sign of genetic deformity or mental retardation, however, the cases were not evaluated by a medical genetics consultant. For those cases, a genetic study should be employed to better understand likely future complications.

Spinal deformity or increased kyphosis in the patient with lung transplants might cause restrictive lung disease, thus, immediate surgery was planned to prevent decreased compliance or elevated pulmonary artery pressure. Spinal metastases of the hepatocellular tumors may require embolization before the operation due to their hypervascular nature. Tan et al. stated that the preoperative embolization of spinal HCC metastases is useful for decreasing intraoperative blood loss [12]. However, another study reported that preoperative embolization had no effect on blood loss but did decrease surgery time [13]. The single patient with spinal metastasis in our study required 9 units of erythrocyte transfusion during surgery. We did not perform preoperative embolization because of the conflicting results of previous studies. Multidisciplinary approaches should be considered for the treatment of spinal metastases, including conventional-stereotactic radiation therapy, radiofrequency ablation, trans-arterial chemo-embolization, chemotherapy (sorafenib), immunotherapy, vertebroplasty-kyphoplasty, cement augmentation, and various types of surgery [14].

As a result of their specific condition, transplanted patients are more likely to develop any kind of complications in the postoperative period. Although Yoshihara et al. reported an increased incidence of neurological complications in this patient group, only two patients in our cohort experienced complications: One dural leak, and one superficial infection, which were resolved in the postoperative period during the hospital stay [15]. Despite their long-term use of immunosuppressant and steroids, none of the patients in our study group developed an infection caused by nosocomial pathogens.

During the hospital stay, we closely monitored the cardiac and renal functions of the patients, and the postoperative period was event free. Since urinary tract infections are commonly observed in transplant patients who underwent spinal surgery, we obtained urine culture specimens on a daily basis and did not observe a bacterial colony growth during the hospitalization [4].

Although the dose of steroids might complicate the healing and fixation process, we did not observe a complication caused by the osteoporotic bone structure during the follow-up period. Because of the increased prevalence of comorbidities and complications in this patient group, a multidisciplinary team should be employed during the pre- and postoperative period. The dose of the immunosuppressant drugs and the agents used for the anesthesia and analgesia management should be carefully adjusted and prescribed to prevent any avoidable adverse event. The additional comorbidities in our patients were spinal stenosis in six, vertebra fracture in three, and vertebral metastasis in one patient. The patients with renal transplantation might have an altering state of fluid retention and distribution in the body compared to the other organ transplants, and special consideration should be given to this population.

Reports suggest that the hospitalization period for this patient group is longer than the patients without a transplanted organ [16]. In our study, the mean postoperative length of stay was 8.5 (5.6) days, and four patients were discharged within a similar number of days compared to the patients without a previous history of transplant surgery.

The mean blood loss during the surgery was slightly higher than the patients without transplantations. The reason for the increased amount of blood loss might be caused by longer operation time. When the need for blood product transfusion arises, the metabolic condition of the patients should be closely monitored, preferably by an anesthesiology team experienced on transplanted patients. Also, a nephrologist should be a member of the team with instructions on the proper use of medications and other interventions.

Limitations

The main limitation of our study is low number of patients. This fact may be expected, since this is a very special group with emphasis on survival of the patient and the transplanted organ. Surgical interventions are largely omitted in these immunosuppressed patients to avoid complications, unless absolutely necessary. Retrospective design and lack of inter and intra group analyses are among other limitations of this study. Further studies with larger patient cohort are needed to derive conclusions supported by statistical analysis.

Conclusion

In conclusion, our report presents a rare case of a patient with hepatocellular carcinoma who received living donor transplantation, with nine other transplanted patients. Our successful treatment modality and low rate of complications indicate that spinal fusion and instrumentation is a safe and convenient approach in transplant patients in a well-equipped hospital setting with an experienced multidisciplinary team under special circumstances.

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