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Surgery-Related Neurosurgical Complications in Elderly Patients: Definition of Risk Factors and Importance of Preoperative Assessments

Yaşlı Olgularda Cerrahi İlişkili Nöroşirürjikal Komplikasyonlar : Risk Faktölerinin Tanımlanması ve Preoperatif Değerlendirmelerin Önemi

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ÖZET:

Amaç: 60 yaş üstündeki nöroşirürjikal olgularda karşılaşılabilecek cerrahi komplikasyonların ortaya konması ve literatür eşliğinde tartışılması amaçlanmıştır.

Materyal ve Metot: Kliniğimizde nöroşirürjikal operasyon uygulanan 60 yaş üzerindeki 283 olgunun dosyaları taranmıştır. Cerrahi lokalizasyona göre; kranial, spinal ve periferik sinir cerrahisi uygulanan olgular olarak 3 farklı grupta değerlendirilmiştir. Komplikasyonların ortaya çıkma süreci; erken hospitalize, geç hospitalize ve geç dönemde görülen koplikasyonlar olarak 3 grupta değerlendirilmiştir.

Bulgular: 117 olguya kranial, 52 olguya spinal, 114 olguya da periferik sinir cerrahisi uygulanmıştır. Uygulanan cerrahi türüne göre karşılaşılan komplikasyonların oranları ortaya konmuştur. Kranial cerrahi uygulanan olgularda erken postoperatif dönemde ve taburculuk sonrası karşılaşılan komplikasyonların sayısı arasında belirgin bir fark bulunmamıştır. En sık karşılaşılan komplikasyon, yara yeri enfeksiyonu olarak tespit edilmiştir. Karnofky skoru düşük olan olgularda, ek nörolojik defisit gelişme sıklığı belirgin yüksek bulunmuştur. Postoperatif iyileşme sürecinin belirgin derecede uzun olduğu görülmüştür.

Sonuç: Yaşlı olgularda nöroşirürjikal komplikasyonlardan kaçınmak için ek önlemler gerekebilir. En sık rastlanılan kompliasyonlar yara enfeksiyonlarıdır. Karnofky skoru değerlendirmesi, postopeatif süreçte yaşam kalitesi ve süresinin öngörülmesinde en önemli paramatrelerden biridir.

Anahtar Kelimeler: nöroşirürjikal komplikasyonlar, yaşlı olgularda komplikasyonlar, yara enfeksiyonu, Karnofsky skoru derecelendirmesi, nöroşirürji

ABSTRACT

Purpose: To reveal the surgical complications that may be encountered in neurosurgical patients over 60 years of age and to discuss them according to literature.

Materials and Methods: The files of 283 patients over 60 years of age who underwent neurosurgical operation in our clinic were reviewed. According to surgery type, they were evaluated in 3 different groups as cranial, spinal and peripheral nerve surgery. The stages of the emergence of complications were evaluated in 3 groups: early hospitalization, late hospitalization, and late period complications.

Results: 117 patients underwent cranial, 52 patients underwent spinal and 114 patients underwent peripheral nerve surgery. Depending on the applied surgical technique, the rates of complications were determined. In patients who underwent cranial surgery, there was no significant difference between the number of complications encountered in early postoperative and post-discharge periods. Wound site infection was the most common complication. In the patients whose Karnofsky score is low, the incidence of additional neurological deficit development was found to be significantly higher. The postoperative recovery period was found to be prominently longer.

Conclusion: Additional methods may need to be used to prevent the development of neurosurgical complications in elderly patients. Among those complications, wound infection is the most common. The Karnofsky score assessment is one of the most important parameters in predicting the quality and length of life in the postoperative period for cranial and spinal surgeries.

Keywords: neurosurgical complications, elderly patients complications, wound infection, Karnofsky score grading, neurosurgery

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INTRODUCTION

The elderly population in the world is increasing each day, parallel to the development of technological possibilities and medical information, and also by the application of safer and more minimal invasive methods. The surgical viability ratio in the elderly population is also increasing. In neurosurgical cases, safer surgical application possibilities can be provided with surgical techniques applied in parallel to these developments and multidisciplinary approaches.[1]

However, there are comorbid factors that cannot be avoided on postoperative mortality and morbidity in elderly patients. The first situation evaluated in these patients is the evaluation of the surgical survival. The determination of suitable surgical technique in cases where conservative methods are not enough, taking adequate measures against comorbid factors, and the best management of all these factors in the postoperative period are the most important parameters.

Elderly patients are evaluated in a separate group for neurosurgical interventions.[2] When a surgical intervention decision is given, there are parameters that should be considered in the preoperative period. As the result of evaluating these parameters depending on the region of the surgery and the general condition of the patient, it is necessary to thoroughly evaluate the expected postoperative recovery or mortality and morbidity expectations. Compared to the younger population, the patients in this age group have higher risk factors because of comorbid factors related to chronic diseases, frequent use of undesired drugs due to cardiovascular and cerebrovascular diseases and surgical intervention, their insufficient immune mechanisms, and variability in their medical histories.[3]

In this study; we evaluated 283 patients who underwent neurosurgical intervention retrospectively. Preoperative patient conditions and surgery related complications were discussed.

MATERIALS AND METHODS

All the patients over the age of 60 who were operated in our neurosurgery clinic between 2014-2017 were retrospectively evaluated. For this purpose, patient files, outpatient records and the results of radiological and laboratory examinations of patients were reviewed retrospectively. The cases with insufficient data for the evaluated parameters were excluded from the study.

The patients were evaluated in 3 different groups as the patients undergone cranial, spinal and peripheral nerve surgery. Complications encountered were evaluated within these groups. Early and late period complications in postoperative hospitalization were evaluated in separate groups. Postoperative first-day complications were evaluated under the title of early period complications, those in the subsequent period were classified under the title of late-hospitalization period complications and the ones encountered in the post-discharge period were classified under the title of late-period complications.

RESULTS

Totally 283 patients underwent neurosurgical intervention; It was recorded that 117 patients had undergone cranial, 52 patients had undergone spinal, and 114 patients had undergone peripheral nerve surgery. The average age was 68,0. 126 patients were female, and 157 patients were male. Out of 283 patients, who underwent cranial and spinal surgery, 146 patients were applied general anesthesia. 18 patients underwent cranial surgery under sedoanalgesia. 3 out of these patients underwent tumor operation by awake craniotomy method. 15 patients were operated with burr-hole method due to single and double-sided chronic subdural hematoma. Five patients underwent spinal surgery under spinal anesthesia. All patients with peripheral nerve surgery were operated under local anesthesia.

The early postoperative periods of the patients were accepted as the moment when the general and spinal anesthesia effect finished. The subsequent period until the discharge was called the late-hospitalization postoperative period.

Karnofsky Performance Status Scale Definitions are shown in Table 1. The complications encountered in patients in the early and late postoperative periods are shown in Table 2. The complications of the patients, according to surgery and primary pathology types were shown in Table 3.

Overall surgical complication rates were; 22,2% for cranial surgeries; 7,7% for spinal and 0,0% for peripheral nerve surgeries in the postoperative early period. The early period postoperative

100 no evidence of disease. 90 Able to carry on normal activity; minor signs or symptoms of disease. 80 Normal activity with effort; some signs or symptoms of disease. 70 Cares for self; unable to carry on normal activity or to do active work. 60 Requires occasional assistance, but is able to care for most of his personal needs. 50 Requires considerable assistance and frequent medical care. 40 Disabled; requires special care and assistance. 30 Severely disabled; hospital admission is indicated although death not imminent. 20 hospital admission necessary; active supportive treatment necessary. 10 fatal processes progressing rapidly. 0 Dead	Able to carry on normal activity and to work; no special care needed. Unable to work; able to live at home and care for most personal needs; varying amount of assistance needed. Unable to care for self; requires equivalent of institutional or hospital care; disease may be progressing rapidly.

Table 1 : Karnofsky Performance Status Scale Definitions

complications were higher then late period complications for cranial surgeries. The late and after the discharge period complications were higher than early period complications in spinal and peripheral nerve surgery complications. Generally; the early period complications had more mortality and/or morbidity (Table 2).

The late period complications were higher in the patients had spinal and peripheral nerve interventions. Generally, these complications were not life-threatening or had less morbidity/mortality results. Conservative treatments were performed for these patients.

DISCUSSION

For the criteria that should be considered in the preoperative period before cranial surgery, it is necessary to predict how the patient will benefit from surgical intervention, to identify risk factors, to evaluate the current medical conditions and the medical treatment he/she receives, and most importantly, to assess the expected life span.[3] Increasing the quality of life or aiming to keep it at the same level is the criteria to be evaluated later.

To objectively evaluate these criteria, the Karnofsky scale is one of the most important scales known (Table 1).[4] While the Glasgow Coma Scale is a criterion for the severity of the coma; the Karnofsky ale is a guide to the effectiveness of the treatment/treatments to be performed.[2] It may not be possible to evaluate the Karnofsky score in patients whose GCS grade is rapidly changing in the acute stage and whose medical history cannot sufficiently be obtained.

Determination of anesthesia type to be applied is of great importance. The follow-up protocol may also change, especially in the early postoperative period, depending on the anesthesia type to be applied to patients whose ASA scores are high and the Karnofsky scores are low. Surgical interventions such as evacuating the chronic subdural hematoma with the burrhole method and burrhole exploration, which are technically easier and expected to last shorter, can also be done without general anesthesia. The awake craniotomy method, which has become increasingly popular in recent times, may also be preferred in patients where complications due to general anesthesia are common.

Additional Neurological Deficit:

The most worrying complication after eliminating the life-threatening etiologic cause is the development of additional neurological deficit.[1] Elimination of a neurological deficits due to acute conditions may be possible depending on the underlying etiological cause, but it is clear that the neurological deficit developed in some cranial conditions cannot completely be eliminated.

Surgery Type	Postoperative early period complications	Postoperative late period complications	Post-discharge complications
Cranial Surgery n= 117	26 (% 22,2)	16 (% 13,6)	21 (%18,1)
Spinal Surgery n= 52	4 (%7,7)	6 (%11,5)	5 (%9,6)
Peripheral Nerve Surgery n= 114	0 (% 0,0)	0 (% 0,0)	4 (% 3,5)
Total : 283			

Table 2 : Complication rates of the patients according to surgery type and follow-up periods.

	Postoperative early period	Postoperative late period	Post-discharge complications	Mean Hospitalization Time
Intracranial Tumor (n=20) (Supratentorial : 12 Infratentorial : 8)	Rebleeding: 0 (other than minor bleedings, detected radiologically) Epilepsy: 2	Wound Infection: 1 CSF fistula: 1	Wound Infection: 1 Epilepsy: 1 Infection: 3 CSF fistula: 1	6,3 days
Traumatic Cranial Pathologies Surgery (n= 45)	Rebleeding: 1 (other than minor bleedings, detected radiologically) Exitus: 2 Epilepsy: 3 Additional neurologic deficit :2	Wound Infection: 3 CSF fistula: 1	Wound Infection: 1 Epilepsy: 1 Infection: 3 CSF fistula: 1	8,7 days
Serebrovascular Diseases n= 52 Chronic Subdural Hematoma : 42 Decompression Surgery (Hemorrhagic/Ischemic) : 10	Rebleeding: 1 (other than minor bleedings, detected radiologically) Exitus: 3 Epilepsy: 2 Additional neurologic deficit: 5	Rebleeding: 2 Exitus: 3 Epilepsy: 2 Wound Infection: 2 Decubitus ulcer: 1	Rebleeding: 6 (Chronic subdural hematoma) Wound Infection: 2 Epilepsy: 1	6,8 days
Spinal Surgery n= 52	Additional neurologic deficit: 1 CSF fistula: 3	Wound Infection: 3 CSF fistula: 3	Wound Infection: 2 Infection: 2 CSF fistula: 1	3,2 days
Peripheral Nerve Surgery n= 114	0	0	Wound Infection: 4	0 day

Table 3 : Complications of the patients according to surgery and primary pathology types

Motor deficits due to occlusive cerebrovascular diseases with an indication of decompression surgery may not possibly be eliminated after surgery. The aim is to eliminate life-threatening causes in the first place. It should be aimed to eliminate the additional neurological deficits due to trauma or tumoral situations in the postoperative period.[5]

In our series, in 9 of 11 patients had hemiparesis symptom due to ischemic or hemorrhagic cerebrovascular disease, chronic subdural hematoma, and traumatic hemorrhage and hemiparesis/hemiplegia also continued in the postoperative period. In follow-up of chronic subdural hematoma patients, paresis appeared to improve over time. In 1 chronic subdural hematoma diagnosed patient; dysphasia, which started in the postoperative period and continued in the follow-up periods. 55 of these patients were urgently operated, the Karnofsky scale could not be evaluated in the preoperative period. GCS was considered as the most critical surgical criterion.

Infection:

In elderly cases, the immune response against to the infectious diseases encountered due to the process is much lower even if it is expected to be more diverse.[6] For this reason, it should be kept in mind that patients who will undergo surgery are susceptible to infection and it should be tried to prevent the infection with additional medications if necessary. For prophylactic antibiotics, it should be kept in mind that antibiotherapies routinely applied in adult populations cannot always be used in elderly populations.[6] In general, the most commonly followed up situations due to antibiotherapy is to find out if there are any known nephropathy and liver problem. If such conditions are encountered, the less nephrotoxic or less hepatotoxic drugs should be selected depending on the surgery performed. Careful treatment of the wound site may be necessary during the hospitalization process, and additional measures should be taken to prevent hospital infections.

In 6 patients who underwent a cranial operation and in 3 who underwent spinal surgery, wound site infections were encountered in their hospitalization stage, whereas in 2 patients with the cranial operation, in 4 with spinal surgery and in 4 patients who underwent peripheral nerve surgery, they were encountered in their post-discharge period. Meningitis was not observed in any of the patients. In 1 patient who underwent the operation for supratentorial tumor destroying the cranium, it was seen that the scalp tissue gradually became thinner and completely opened (Figure 1). An additional surgical intervention was not planned to for the scalp due to her low Karnofsky score and very high comorbidity and protected from the infection by conservative methods and wound site care.

Figure 1 : Late period, large scalp defect after surgery of supratentorial tumor metastasis on calvarium.

Postoperative Hemorrhage:

One of the most common and feared complications in neurological cases is hemorrhage recurrence at the surgical site. Bipolar coagulation is used for bleeding control in brain parenchyma related situations. In particular, the use of bipolar should be avoided as much as possible, in the so-called eloquent area or the proximity of vital structures.[7] Preparations that do not damage parenchyma and are known as antihemorrhagics are frequently used in the surgery of these areas.[8]

In elderly patients, the use of antiaggregant and anticoagulant is very high, depending on cardiovascular or neurological diseases. In

elective cases, it is advisable to discontinue these medications if possible, until the bleeding parameters come up with the appropriate values. In emergency patients, on the other hand, if the PT and aPTT values are high, it is aimed to meet the missing factors with urgent plasma support. Thrombocyte suspensions are used simultaneously in patients who have low platelet counts. In immune thrombocytopenic purpura patients, on the other hand, low platelet counts are due to the presence of autoantibodies and platelet replacement has no benefit. In such patients, corticosteroid and intravenous immunglobuline (IVIg) treatment should be started urgently.[9] In patients using acetylsalicylic acid, thrombocyte adhesion is impaired, although platelet count and bleeding parameters may be normal. In such patients, urgent platelet replacement may be helpful. During the postoperative period, in patients who are expected to have a high probability of bleeding, different clinics recommend patients to be followed-up under sedation with mechanical ventilation support in the early period, but this method makes it difficult to assess the neurological pattern of the patient in the early postoperative period. Therefore, in the early postoperative period, whether the patient will be examined under sedation should be assessed depending on the patient, and it should be checked whether there is bleeding recurrence with frequent intervals of CT examinations.

In our series, in 7 patients who underwent a cranial operation, hemorrhage was detected at the surgical site during their hospitalization stage, and surgical intervention was considered for 1 patient (Figure 2). Antiaggregant and anticoagulant use were found in 24 patients who were urgently taken to the surgery. In 1 patient with ITP, corticosteroids were started in preoperative and postoperative periods. Other patients were operated with plasma support.

In very high-risk patients, applications like placing a silicone drain with very low or no negative pressure to the cerebral parenchyma for protection from hematoma can be performed, but its effectiveness and risks are controversial.

CSF Fistula:

In both cranial or spinal intradural surgeries or during regional epidural surgery, the CSF fistula, which can occur after dura mater damage, is one of the most feared complications in neurosurgical procedures.

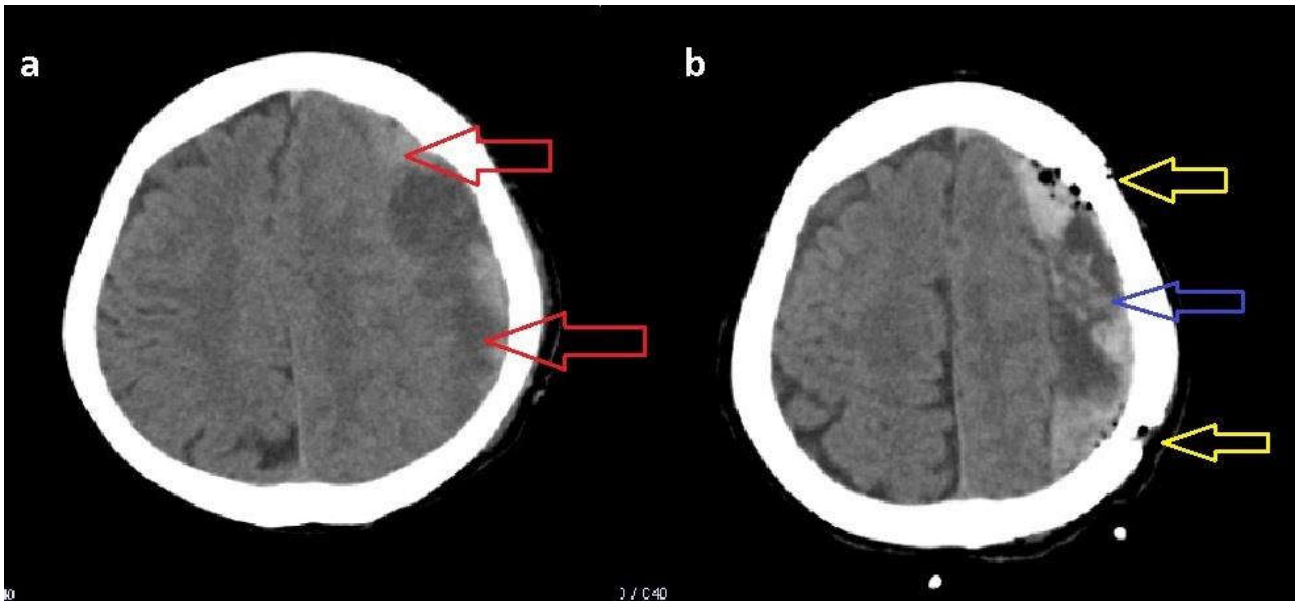

Figure 2: Left fronto-parietal subdural hematoma with acute component, red arrows. (a). Rebleeding in the surgical side on postoperative 1st day (b) (burrholes: yellow arrows, double component subdural hematoma: blue arrow).

While primary repair of the dura mater is the most reliable method, duraplasty with autografts such as fascia, muscle or with dural grafts, or dura repair with adhesives is performed in patients whose dura maters cannot be repaired by primary suturation (Figure 3).[10]Although the tissues around dura mater are considered as barriers that can prevent CSF from leaking out of the skin, these tissues and anatomic structures should never be considered as protective barriers. It is almost inevitable to encounter the CSF fistula unless the dura mater repair is primarily and certainly performed. Failure to repair the damaged dura mater sufficiently can lead to serious complications, can predispose for infections such as meningitis, decrease the quality of life, extend the hospitalization, and change the medication change. CSF fistula is encountered more frequently after posterior fossa surgery or ventricle- and cisterns-associated lesion surgery (Figure 4). Even if the primary dura mater repair is performed, dura adhesive preparations can sometimes be routinely applied after dural suturation, because of the high rates of CSF fistula development.[11]

Figure 3 : Use of muscle flap and dural adhesive glue to prevent CSF fistula after posterior fossa surgery

In our patients who underwent cranial surgery, the primary dural closing was made with vicryl 3-0, and the dura mater was closed with continuous suture. The synthetic dura material was not used in any of the patients for whom dura mater repair was necessary, and in all these patients, the galea texture was used for duraplasty after being brought to the proper size and shape. In posterior fossa and ventricle-related surgeries, dura adhesives were routinely applied to the incision after the dura was closed. In one patient who underwent posterior fossa surgery, a subcutaneous CSF leak was detected after discharge, after 4-day lumbar drainage application, it was seen that the leak was repaired. In these patients, instead of surgically repairing the CSF leak, trying the conservative methods as much as possible can lead to better results.[12]

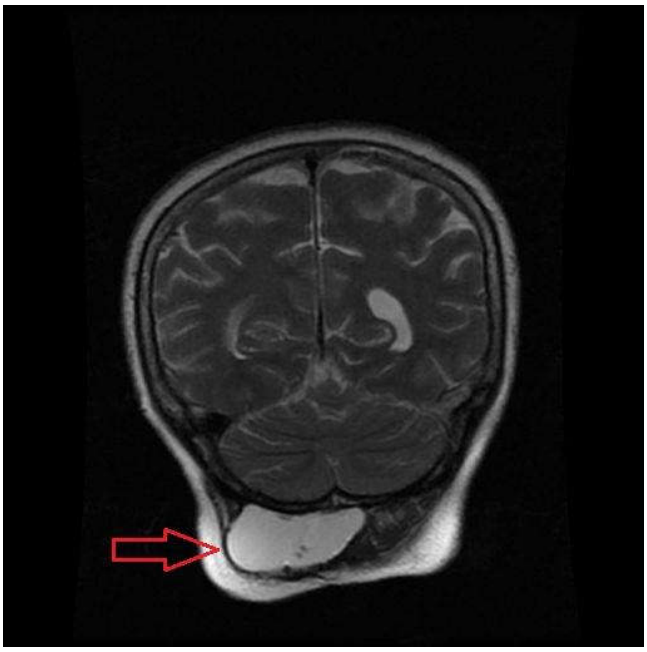

Figure 4: CSF leakage on surgical side after posterior fossa operation (red arrow)

During spinal surgery in elderly patients, the spine's being in the degenerative stage, ligamentum flavum hypertrophy, neural structures' being under compression for a long time, and the fact that these tissues are in close contact with the surrounding tissues may lead to the development of dura mater injury more easily.[13-15]

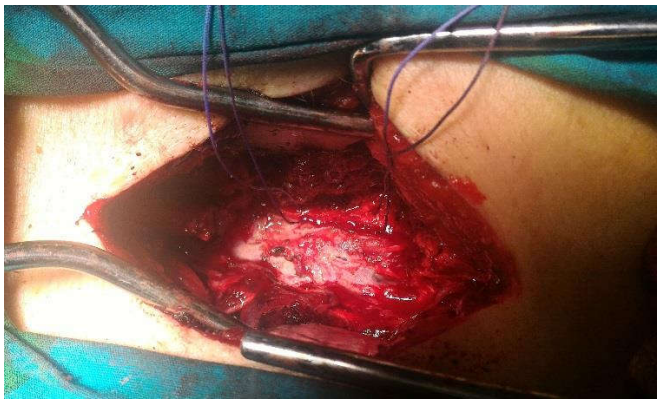

Figure 5 : Use of dural adhesive glue after spinal intradural surgery to prevent CSF fistula.

Figure 6: CSF leakage on surgical side after spinal operation on second month.

Dura mater healing is more difficult in these patients compared to younger ones. For this reason, more care should be taken when dura mater repair is performed in elderly patients (Figure 5, 6).

Wound Infection:

Depending on the surgical procedure applied, failure of surgical wound closure with the proper suture material and by the appropriate technique, failure to provide hygiene can lead to wound infection.[16,17] Since the immune system, particularly in the elderly population, is weaker than younger adults, additional hygiene might be required for wound care or additional medications accelerating wound healing may be applied.[18] The most important criterion before additional medication is to keep the patients away from molecules that may adversely affect wound healing and ensure them to be nourished well. In patients who need to remain immobile for a long period, supporting the pressure areas by a pressure mattress, frequently changing the position in the bed are among the measures can be taken. If there is no contraindication, it is very important to mobilize the patients as soon as possible. Mobilization can prevent not only decubitus ulcers, but also the development of thromboembolism. Incision closure with appropriate technique at the end of surgery is also very important.[19] The closure of the incision with a very tight sutures can delay wound healing by reducing wound site circulation, which may lead to wound infection. In the case of a very loose closure, after blood leakage, a suitable ground for infection might form around the wound site.

In our patients, it was ensured that the dressings were opened starting from the 2nd or the latest the 3rd days after all surgical procedures unless there was a contraindication. Keeping the surgical incision closed for a long period to protect it from its surroundings can delay wound healing contrary to what is expected.

In our series, in 4 patients who underwent spinal surgery, fat necrosis followed by a wound infection developed and the patients were hospitalized and given dual antibiotherapy. After wound debridements, secondary wound healing was achieved. Particular attention should be paid to wound site care in obese patients.[20] If necessary, topical antibiotherapy should be used to provide wound site care. In 4 patients who underwent peripheral nerve surgery, as the the wound healing was insufficient and there was infection, topical antibiotherapy was applied for one week, in 1 patient, the surgical incision was re-sutured. Moreover, it was found out that there is an uncontrolled diabetes mellitus history in 4 patients.

Thromboembolism and Deep Vein Thrombosis:

Development of thromboembolism in patients that remain immobilized for a long period can lead to high morbidity and mortality rates.[1] In patients that cannot be mobilized, methods such as low molecular weight heparin therapy and using compression stockings are some of the measures that can prevent the development of thromboembolism.

Thromboembolism was not encountered in any of the patients in our series. All of the patients were mobilized as early as possible. Mobilization of the patients having difficulties in mobilization was provided with a wheelchair in the early period and with support later on.

Conclusion:

Additional methods may need to be used to prevent the development of neurosurgical complications in elderly patients. Among those complications, wound infection is the most common. The rate of the additional neurological deficit development is high. The Karnofsky score is one of the most important objective parameters for assessing postoperative life expectancy and quality.

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