Risk indicators for the development of pressure ulcers in spine surgery

Fatores de risco para o desenvolvimento de úlceras de pressão nas cirurgias da coluna vertebral

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ABSTRACT

Introduction: According to literature review, pressure ulcers (PU) are a very concerning problem in cases where the time of surgery is superior to 4 hours. A better knowledge of PU incidence and the necessity of its prevention have demonstrated to be very important in the surgical practice. Material and methods: A brief description of PU as well as its classification and socioeconomic importance is presented. Results: Pressure ulcers may be considered an important and in some cases - one undisclosed early complication in the post operative period ,mainly in spine surgery. Conclusion: Diagnosis and prevention of pressure ulcers are mandatory in patients considered at increased risk to develop PU. Further studies should be carried out in order to investigate factors associated with PU development and prevention among surgical patients. Key-words: pressure ulcers, intraoperative ulceration, surgical complication.

RESUMO

Introdução: De acordo com revisões de literatura, as escaras de pressão (EP) representam um importante problema, em casos de cirurgias com duração superior a 4 horas. Consideram-se um melhor conhecimento da incidência das EP e a necessidade de sua prevenção como elementos importantes na prática cirúrgica. Material e métodos: Uma breve descrição das EP assim como sua classificação e importância socioeconômica é apresentada. Resultados: As EP podem ser consideradas como uma importante complicação pós operatória, especialmente nas cirurgias da coluna e, em alguns casos, de aparecimento não verificado no período pós operatório precoce. Conclusão: O diagnóstico e a prevenção das EP são fundamentais em pacientes considerados com maior tendência a apresentar um risco elevado para o desenvolvimento de EP. Outros estudos deveriam ser efetuados visando a uma melhor investigação de outros fatores relacionados com o desenvolvimento e prevenção de EP em pacientes submetidos a cirurgias. Palavras-chave: úlcera de pressão, escaras de pressão, escaras de decúbito, complicaçao cirúrgica
ARTIGO ORIGINAL

J Bras Neurocirurg 20 (3): 341-344, 2009

Prandini MN, Martinez AS - Risk indicators for the development of pressure ulcers in spine surgery.

INTRODUCTION

A common problem for neurosurgical patients is the development of pressure ulcers (PU)\(^{25,26}\). According to the European Pressure Ulcer Advisory Panel (1999)\(^{6}\), a PU is an area of localized damage to the skin and to the underlying tissues caused by pressure, shear, and friction.

The risk of PU development is directly related to the intensity of the pressure and shearing forces as well as the duration of the surgical procedure\(^{4,5,17}\).

The improvement and safety of anesthesiology, permitting neurosurgical procedures to have an extended time, the development of new devices to be implanted in the spinal column, the possibility of correction of more complex deformities are requiring an extended surgical time and so the development of more postoperative complications. Increase of PU development may be considered as one of these complications.

The knowledge and consequently the prevention of PU may avoid one important postoperative complication in those patients.

DEFINITION

Pressure ulcers are skin or soft tissue lesions deep or superficial, if ischemic in origin, as a result of an increase of external pressure and shearing forces. PU can occur in every region of the body but regions of osseous prominences are more prone to the development of PU. In these regions, the layer of tissue between the skin and bone is thin, allowing the entire pressure to be transmitted to the underlying tissue.

CLASSIFICATION

The generally accepted classification is in four stages \(^{9,22}\).

Stage1. Discoloration of intact skin. - Discoloration not altered by light finger pressure. Stage2. Partial-thickness skin loss or damage of epidermis and dermis. There is blister, abrasion and shallow ulcer, without involvement of adjacent tissues. Stage3. Full-thickness skin loss involving damage or necrosis of subcutaneous tissue. There is no extension to the underlying bone, tendon or joint.

Stage4. Full-thickness skin loss with extensive tissue destruction and necrosis. There is extension to underlying bone, tendon and joint.

Blanchable eritema is considered a normal reaction of the skin to ischemia, and not an early stage of PU, that are defined as a discoloration of the skin which blanches when light pressure is applied. There are no hardened places and sensation is intact.

EPIDEMIOLOGY

The incidence of intraoperative acquired PU has been reported to be as low as 12% and as high as 66%\(^{1,18}\). Studies have reported an incidence rate of 25% and 27.2% for patients undergoing cardiac surgery and 36% incidence for patients undergoing spine surgery \(^{1,12,16}\).

According to Haalboom et al.\(^{9}\), the incidence of PU in the overall hospital population ranges from 1% to 11%, whereas the incidence of PU in surgical patients varies between 4.7% to 66%.

In Netherlands, the Health Council \(^{11}\) has estimated that the costs of UP are superior to €53,780,000, which represents more than 1% of the total cost of health care in the Netherlands in 1988. In the USA, Miller et al.\(^{14}\) estimate the costs of PU ranging from $11.335 billion to 8.5 billion per year\(^{1,12}\). The treatment of a single PU has been estimated to cost $14,000 to $40,000. It has been estimated that\(^{14}\) it costs nearly 2.5 times more to treat than to prevent PU. Considering the length of stay for a patient with PU, there is an increase of 3.5 to 5 days when compared with those without PU\(^{1}\).

PRESSURE ULCER RISK FACTORS

Not too many studies have attempted to investigate factors associated with PU among surgical patients\(^{8,9,13,25,26}\). A few studies have concluded that the development of PU has been studied to a limited extent only among mixed groups of surgical patients\(^{2,8,24}\). Studies among non surgical patients have shown that nutritional predictors\(^{13}\) such as low serum albumin and low body mass index are of great importance. Low blood pressure may be considered as an additional predictive factor as well. However, many other risk factors for the development of PU have been reported. According to the European Pressure Ulcer Advisory panel (1998)\(^{9}\) it has been widely accepted that pressure and shearing forces are the main cause of PU, although pressu-
re and shearing forces do not explain the occurrence in many cases. Other important factors include overweight, patient age, length of surgery and patient positioning. Schoonhoven et al.\textsuperscript{18} consider that patients undergoing surgery lasting more than 4 hours are prone to develop PU. One of the most cited risks is the patient positioning during surgery. Spine surgery patients are considered of high risk to develop PU\textsuperscript{16}. The duration of the immobility is even longer than the duration of the surgical procedure. Another surgery-related factor include the use of warming blankets or warming mattress that increase the oxygen demand of the tissue and therefore increases the risk of PU. Grous et al.\textsuperscript{7} found the use of warming blanket with patients who underwent surgery lasting longer than 10 hours to be an important risk factor. According to Bergstron and Barden\textsuperscript{2}, a diastolic blood pressure below 60mm Hg increases the risk for PU. Seiler and Satahle\textsuperscript{21} report that the decrease of tissue perfusion caused by arterial hypotension makes the tissue more vulnerable, in cases where some kind of local pressure is occurring. However PU etiology has not been fully explained so far\textsuperscript{9,13,16,21,24,25}.

**TIME BETWEEN DEVELOPMENT AND CLINICAL OBSERVATION OF PU**

According to Shea\textsuperscript{22}, PU initially develops in muscle and subcutaneous tissue, progressing outward dermal and epidermal skin layers. Muscle is damaged first because pressure is the greatest over the bone, decreasing progressively toward periphery. It is well known that PU are not always visible immediately after surgery. Defloor and Scuijmer\textsuperscript{1} report that 3 to 5 days can pass between development and observation of PU but even during the first 48 hours after surgery, PU may be diagnosed in a few patients. Patient observation soon after surgery and twice daily during hospitalization is mandatory for diagnosis and treatment of PU\textsuperscript{1,3,4,10}.

**PREVENTION OF PU**

It is quite difficult to avoid one special factor in order to prevent the development of PU, since in many cases its origin is very difficult to be discovered. Obese patient, advanced age, the ones suffering from vascular and heart diseases, arterial hypertension, diabetes, cancer patients as well as patients presenting with motor deficits including hemiplegia, tetraplegia or paraplegia have an increased chance to develop PU. Operations lasting more than 4 hours require special attention regarding to the patients positioning or in some cases, the anesthesiologist is supposed to change the position of the head every 30 minute to avoid the risk of alopecia\textsuperscript{4}. In cases at a high risk of development of PU, mainly in spine surgery, changing the position of the patient after a few hours could be a good practice in order to avoid PU development. Special preoperative care, including the study of serum albumins in every patient, the avoidance of using warming blankets, special care in the patient positioning, its observation and eventual correction during surgery. The abbreviation of the surgical time in cases at high risk by means of a special surgical planning may be a valuable option. Scott et al.\textsuperscript{20} based on a randomized trial recommend the avoidance of cold temperatures in the operating room. According to Poveda et al.\textsuperscript{15}, the ideal temperature of the operating room is between 20º to 23ºC in order to minimize PU development. The careful observation of regions more susceptible to PU in the immediate postoperative\textsuperscript{(1)} and twice a day during the hospital stay can minimize the intensity and severity of PU\textsuperscript{(13,16,19,23)}.

**CONCLUSION**

Improvement of spine surgeries, permitting more complexes procedures to be carried out, the development of new devices to be implanted, the possibility of correcting more and more severe deformities are requiring an extension in the length of surgeries. Obese patients are more prone to develop spinal deformities, some of which are able to be treated in the present days; this group of patients have a higher tendency to develop PU. That is why the report of postoperative PU is increasing every year. Therefore, the knowledge of PU, its prevention and careful evaluation of risk factors is becoming a very important issue mainly in cases of surgeries lasting more than 4 hours and in cases of patients who are known to present with increased risk factors.

**FURTHER RESEARCH**

Other risk factors should be investigated, since not all of them have been enough to explain PU development. Further research is needed to determine risk factors and preventive measures that are specific to PU during surgery as constitutional and modifiable risk factors\textsuperscript{4}. Perhaps, the development of new mattresses specially adapted for spine surgeries of long duration could be a helpful tool in the PU prevention.
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