

Briefly about Ureteral Wounds

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Abstract

A wound is a force-induced disruption of tissue continuity, i.e., the outer or inner body surface. The range varies greatly and ranges from the simplest scratch to deep wounds with damage to internal organs or complete rupture of a part of the body. Although some wounds look harmless, all require proper treatment with the use of an appropriate antiseptic. This avoids the possibility of infection and ensures better and faster healing.

Keywords: wound; injury; blood; healing

Introduction

Wound healing is a dynamic process that demonstrates the body's ability to respond to change in its protective integrity and maintain homeostasis by swiftly responding to this change [1]. Wounds, either surgically or trauma induced, are a form of cellular injury that leads to a tissue response. This response is a complex process which involves the removal of necrotic tissue and induction of repair. When tissue injury occurs, the damaged blood vessels haemorrhage into the defect, platelets aggregate, and a thrombus forms. This process allows the interaction with the complement system, and inflammatory cells are attracted to the site of injury by chemotactic factors. Platelets play an essential role in this response as they release two important factors. These factors are platelet-derived growth factor (PDGF) and transforming growth factor beta (TGF- β); they are powerful chemotactic factors for inflammatory cells such as macrophages, which then migrate into the wound to phagocytose necrotic tissue and fibrin. PDGF induces the cells to change from the resting phase in G0–G1. Epidermal growth factor (EGF) and insulin-like growth factor (IGF) act to induce cell progression from G1 phase to DNA synthesis. Capillary proliferation is stimulated with angiogenic growth factors such as vascular endothelial growth factor (VEGF). The defect is repaired by capillary hyperplasia, myofibroblasts, and epithelial cells. Nutrients and hormones play a vital role in the wound-healing process, as insulin, thyroid hormones, glucose, amino acids, and vitamin C. The deficiency in nutrients or vitamins or the presence of infection or poor local circulation may lead to delay in wound healing.

Injury

The cell is a dynamic entity that maintains homeostasis despite continuous changes in the environment [1]. When the changes are severe, cellular injury will occur. There are various mechanisms of cellular injury: physical, chemical, and biological. In surgery, these three mechanisms may occur simultaneously or sequentially. A surgical incision is a form of

physical injury or trauma to the tissue that may result in another form of tissue insult, such as hypoxia and predisposition to infection as a result of the breach of protective barriers. The response to injury also depends on various factors, such as, the nutritional status of the patient, blood supply to the injured area, and immunity. Previous radiation or chemotherapy may preclude an adequate response of the tissue to heal.

The response to cellular injury whether pathological as in trauma or physiological as in surgery is the same, and that is the process of inflammation. The inflammatory response is a sequential reaction to cellular injury. The mechanism of inflammation is basically the same regardless of the insulting agent. The response depends on the extent and the severity of injury and on the patient's individual response. The inflammatory response can be divided into a vascular response, cellular response, formation of exudate, and healing.

Blood Flow

Arterial pressure is a function of both vasomotor tone and cardiac output [2]. The local vasomotor tone also determines blood flow distribution, which itself is usually determined by local metabolic demands. For a constant vasomotor tone, vascular resistance can be described by the relation between changes in both arterial pressure and cardiac output. The body defends organ perfusion pressure above all else in its autonomic hierarchy through alterations in -adrenergic tone, mediated through baroreceptors located in the carotid sinus and aortic arch. This supremacy of arterial pressure in the adaptive response to circulatory shock exists because both coronary and cerebral blood flows are dependent only on perfusion pressure. The cerebral vasculature has no -adrenergic receptors; the coronary circulation has only a few. Accordingly, hypotension always reflects cardiovascular embarrassment, but normotension does not exclude it. Hypotension decreases organ blood flow and stimulates a strong sympathetic response that induces a combined -adrenergic

(increased vasomotor tone) and -adrenergic (increased heart rate and cardiac contractility) effect and causes a massive ACTH-induced cortisol release from the adrenal glands. Thus, to understand the determinants of arterial pressure one must also know the level of vasomotor tone. The determinants of arterial pressure can simplistically be defined as systemic arterial tone and blood flow. Since blood flow distribution will vary amongst organs relative to their local vasomotor tone and arterial pressure is similar for most organs, measures of peripheral resistance, by any means or formula, reflect the lump parameter of all the vascular beds, and thus, describe no specific vascular bed completely. If no hemodynamic instability alters normal regulatory mechanisms, then local blood flow will also be proportional to local metabolic demand. Within this construct, the only reason cardiac output becomes important is to sustain an adequate and changing blood flow to match changes in vasomotor tone such that arterial input pressure remains constant. Since cardiac output is proportional to metabolic demand there is no level of cardiac output that reflects normal values in the unstable and metabolically active patient. However, as blood pressure decreases below a mean of 60 mm Hg and/or cardiac indices decrease below 2.0 liters/min/m², organ perfusion usually becomes compromised, and if sustained it will lead to organ failure and death. Presently, only one clinical trial examined the effect of increasing mean arterial pressure on tissue blood flow. When patients with circulatory shock were resuscitated with volume and vasopressors to a mean arterial pressure range of 60–70, 70–80 or 80–90 mm Hg, no increased organ blood flow could be identified above a mean arterial pressure of 65 mm Hg. Clearly, subjects with prior hypertension will have their optimal perfusion pressure range increased over normotensive patients. Thus, there is no firm data supporting any one limit of arterial pressure or cardiac output values or therapeutic approaches based on these values that have proven more beneficial than any other has. Accordingly, empiricism is the rule regarding target values of both mean arterial pressure and cardiac output. At present, the literature suggests that maintaining a nonpreviously hypertensive patient's mean arterial pressure 65 mm Hg by the use of fluid resuscitation and subsequent vasopressor therapy, as needed, is an acceptable target. Previously hypertensive subjects will need a higher mean arterial pressure to insure the same degree of blood flow. There is no proven value in forcing either arterial tone or cardiac output to higher levels to achieve a mean arterial pressure above this threshold. In fact, data suggest that further resuscitative efforts using vasoactive agents markedly increase mortality, and the relatively new concept of 'delayed' and 'hypotensive resuscitation' for traumatic hemorrhagic shock on the other hand had shown improved outcome in some clinical and experimental studies. However, these studies were done in trauma patients with penetrating wounds and no immediate access to surgical repair. Once a patient is in the hospital and the sites of active bleeding addressed, then aggressive fluid and pressor resuscitation is indicated.

Perineal Wound

In women undergoing vaginal delivery about 85% are known to sustain some form of perineal injury [3]. The short-term sequelae of perineal injury include bleeding and pain, but may include wound complications such as infection, dehiscence and granulation tissue. Persistent pain after eight weeks postpartum occurs in about 22% of women and with about 20% experiencing dyspareunia.

Anal dysfunction such as faecal or flatus incontinence can occur with obstetric anal sphincter injuries (OASIs). In the long term, perineal trauma such as levator muscle avulsion has been postulated as risk factors for pelvic floor disorders such as pelvic organ prolapse and urinary incontinence.

Perineal wound infection and dehiscence can have serious consequences on a woman's general health and quality of life. These problems include persistent pain and discomfort at the perineal wound site, urinary and bowel problems, and dyspareunia, as well as psychological and

psychosexual issues from perceived or altered body image. The most serious complication that can arise is systemic sepsis. It is imperative, therefore, that women with suspected perineal infection are reviewed urgently. Women who have problems with their wound in the form of increasing pain, excessive or offensive discharge, pyrexia, feeling generally unwell, swelling of the wound, or evidence of wound dehiscence should have an urgent assessment.

There is a paucity of validated tools for the objective assessment of perineal wounds for the early detection and follow-up of wound infection. Until a more specific tool is available, we recommend the use of the REEDA score for perineal wound assessment. The REEDA tool assesses Redness (R), Edema (E), Ecchymosis (bruising) (E), Discharge (D) and approximation of the perineal wound edges (A). Its scientific merit relies upon taking precise measurements and providing objective descriptive data to assess the condition of the wound over a period of time. If a wound infection is suspected, microbiological swabs should be taken from the perineal wound area and the woman should be prescribed appropriate broadspectrum antibiotics. The prescribed antibiotics should be reviewed once the swab results are available. Further follow-up appointments will depend on the severity of infection, presence of wound breakdown, and general maternal condition. In general, it will be appropriate for the woman to be seen in the clinic weekly for the first two to three weeks. With each visit, an objective assessment of the wound condition using REEDA score should be performed and documented. Once the infection is cleared and the wound has healed, it would be prudent to arrange a follow-up visit after 8–12 weeks or even later, to check for any long-term complications such as perineal pain or dyspareunia.

Closure

The specific wound closure technique may be determined by wound type [4]. Primary wound closure is appropriate for clean and clean-contaminated wounds. Skin may be closed with absorbable monofilament or staples. Secondary closure is appropriate for heavily contaminated wounds. The fascia is closed primarily, and the skin and subcutaneous tissues are allowed to heal by wound contraction and epithelialization. Delayed primary closure (tertiary closure) is typically reserved for patients with abdominal compartment syndrome or patients requiring planned reoperation, where fascia and skin are closed only after an initial period of observation. Negative-pressure vacuum-assisted closure (VAC) devices may be useful adjuncts for secondary or tertiary closure. These provide enhanced wound debridement and protection from the external environment. Open abdominal VAC systems also exist for temporary abdominal closure.

Ureteral Wound

Most ureteral injuries are iatrogenic in the course of pelvic surgery [5]. Ureteral injury may occur during transurethral bladder or prostate resection or ureteral manipulation for stone or tumor. Ureteral injury is rarely a consequence of penetrating trauma. Unintentional ureteral ligation during operation on adjacent organs may be asymptomatic, though hydronephrosis and loss of renal function results. Ureteral division leads to extravasation and urinoma.

If the ureteral injury is not recognized at surgery, the patient may complain of flank and lower abdominal pain on the injured side. Ileus and pyelonephritis may develop. Later, urine may drain through the wound (or through the vagina following transvaginal surgery) or there may be increased output through a surgical drain. Wound drainage may be evaluated by comparing creatinine levels found in the drainage fluid with serum levels; urine exhibits very high creatinine levels when compared with serum. Intravenous administration of 5 mL of indigo carmine causes the urine to appear blue-green; therefore, drainage from a ureterocutaneous fistula becomes blue, compared to serous drainage.

Anuria following pelvic surgery not responding to intravenous fluids may rarely signify bilateral ureteral ligation or injury. Peritoneal signs may occur if urine leaks into the peritoneal cavity.

Injury in Children

The goals of care focus on preservation of renal tissue and renal function while minimizing the morbidity and risk of mortality posed by the injury [6]. Most blunt renal injuries can be managed non-operatively, particularly since the majority are low grade. Conservative management usually involves bed rest until hematocrit measurements have stabilized and hematuria has resolved. Monitoring of vital signs is imperative to assess hemodynamic stability. Although reevaluation with ultrasound can be used to detect any expanding urinoma or hematoma, CT imaging is indicated if there is deterioration in the child's clinical condition or hemodynamic instability which might necessitate surgical intervention. Conservative management is highly successful in preventing long-term complications such as hypertension, loss of renal function and hydronephrosis.

At the time of operation, the initial priority is to gain vascular control of the renal pedicle and aorta. Once hemostasis has been achieved, the kidney and collecting system can be inspected, devitalized tissue can be debrided and any defects in the parenchyma closed and covered wherever possible. In certain cases partial nephrectomy may be a better way of preserving the remaining viable renal tissue. Urinary extravasation can be managed with a ureteral stent or nephrostomy tube. As stated above, emergency repair of a severe pedicle injury or thrombosis is unlikely to result in preservation of the kidney since the warm ischemic time will already have been exceeded while the child was being evaluated and resuscitated prior to surgery. Penetrating trauma is most commonly the result of gunshot or stab wounds and is, therefore, largely confined to the older age group. Because these injuries tend to be more severe and involve other organs there is usually a greater requirement for blood transfusion and stronger likelihood of nephrectomy. While stab wounds and low-velocity gunshot wounds may cause localized injury, high-velocity gunshot wounds are associated with blast effect tissue damage, which may make it more difficult to determine the true extent of injury on initial evaluation.

Healing

The healing process in the urinary tract after surgical intervention is slightly unique from other tissues because of the presence of urine [1]. Due to the various surgical approaches in urological surgery, the technique involved, the location of the procedure, and the organ operated on, all contribute to the outcome of this process.

The common notion of dividing the urinary tract during surgery, which is applied in open surgery, involves division and suture of tissue. The tissue edges are bonded with fibrin, which will stimulate the growth of capillaries to form granulation tissue which will be gradually replaced by fibrous tissue, which matures to form a scar in the course of few weeks to months as a result of the remodelling process. NP The traditional nursing role is similar throughout the world and generally involves patient observations, toileting, personal hygiene assistance, medication administration, wound care, post-operative care, and specific tasks assigned to them by the doctors in charge of the patient's care [7]. In many countries, however, this role has evolved not only as a result of reduced working hours for doctors and increasing demands for health services, but

also due to enhanced education for nurses. NPs (Nurse Practitioner) not only provide advanced clinical care but are also involved in research, audit, education-and-policy development, and they have an organisational role, as part of management teams; they may also be responsible for budgets, purchasing, and finding suppliers.

From a clinical perspective NPs work autonomously, providing general and specialist health assessment, diagnostic investigations and treatment planning, as well as performing certain treatments. Many will be independent nurse prescribers. Ultimately, NPs in specialist practice are exercising higher levels of judgement, discretion, and decision-making in clinical care. A significant part of the role is also in the education and counselling of patients regarding their condition, prognosis, and available treatments, in addition to being a patient advocate.

Conclusion

There are many reasons why different wounds heal differently quickly. The cause of the wound, whether it is an injury or a specific disease, is of primary importance, but there are also specific factors regarding the patient, such as his age, health condition, medications which she or he uses, etc. Finding an effective therapy is a significant challenge for medical professionals. The basic and desired goal of treatment is to heal wounds and prevent their recurrence. The success of wound healing depends on the hygienic condition of the wound, the preparation of the wound, the choice of wound dressing, the experience of the healthcare professional and the condition of the patient.

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