Wound Healing Problems in Revision Hip Arthroplasty

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Background: Per primam healing of surgical wound is obligatory for good results after arthroplasty. Surgical wound complications can lead to deep periprosthetic infection, therefore a devastating complication. Surgical wound healing is affected by multiple factors related to underlying disease, patient comorbidities, lifestyle, nutrition and associated medications. If these are combined, the risk of periprosthetic infection is greater. **Material and methods:** We studied wound healing problems on 57 cases of revision hip arthroplasties performed between 2008–2010. The wounds were monitored daily, and the changes were noted and scored.

Results: All the 57 patients presented various predisposing factors for wound healing complications, 12 patients (21.05%) had a two-stage revision and 11 patients (11.29%) presented wound healing problems.

Conclusion: Per primam wound healing is a basic requirement in hip arthroplasty. Any change noted during wound healing should be treated seriously.

Keywords: surgical wound, healing problems, periprosthetic infection

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Introduction

Orthopaedic surgery is characterized by scheduled surgical procedures, in which a series of metal alloy or plastic implants are used. In this surgical specialty, wound healing problems carry a special risk, because the implant may be affected. Postoperative per primam wound healing in orthopaedics generally, and especially in arthroplasties, provides better joint function and an improved quality of life for the patient, one that is as close as possible to the normal.

Material and method

In the 2008–2010 period the same team of surgeons performed 265 different types of orthopaedic surgeries in our clinic. This study on wound healing problems is based exclusively on the 57 revision hip arthroplasties performed over this period. These revisions were performed for the causes presented in Table I.

The age of the patients ranged between 49 and 82 years, with an average of 67.8 years, while 63% of the patients were female, and 37% male.

Table II presents the known predisposing factors of the patients for surgical wound healing complications.

For each patient, a thorough medical history was taken preoperatively and any change that may affect wound healing and/or may promote the occurrence of periprosthetic complications were noted. In each case the surgical wounds were monitored with a daily regularity, and all changes were noted and scored. Our scoring method is presented in Table III.

The scoring method aims to specify the gravity of wound complications and thus guide decision making for the treatment protocol. Intraoperatory blood loss was also adequately and immediately corrected with red blood cell

Table I. The causes of revision hip arthroplasties

Causes	No. of patients	Percentage
Periprosthetic fracture	6	10.52%
Prosthetic implant degradation	3	5.26%
Mechanical loosening	36	63.15%
Two-stage revision for infection	12*	21.05%

*5 with PMMA spacer and 7 with Girdlestone hip

Table II. Predisposing factors for surgical wound healing complications

Predisposing factors already present at the time of admission				
Obesity, BMI >30 kg/m ²	34			
Diabetes mellitus type I	11			
Diabetes mellitus type II	26			
COPD	4			
Rheumatoid polyarthritis	7			
Chronic thromboprophylaxis	9			
Urinary tract infection history	7			
Venous thrombosis	2			
Smoking	21			
Malignant tumor (colostomy)	1			
Preoperative anemia	4			
Perisprosthetic infection	12			
Hepatic diseases (viral and toxic)	9			
Associated predisposing factors	38			
Predisposing factors arising intra or postoperatively				
Time of surgery > 120 min	14			
Intraoperative blood loss > 500 ml	9			
Postoperative blood loss > 500 ml	24			
Difficulties for wound suturing	7			
High doses of thromboprophylaxis	11			
Urinary bladder catheterization > 48 h	17			
Residual hematoma	9			
Predisposing factors association				
2 factors	26			
3 factors	16			
> 3 factors	11			

Table III. Wound Healing Complication Score

Postoperative days	Points	Day 1	Day 2	Day 3	Day 4	Day 5
Secretion between the stitches	1 pt					
Secretion at the site of the drains	1 pt					
Swollen wound	1 pt					
Swollen and hyperemic wound	2 pts					
Swollen, hyperemic and endured wound	3 pts					
Marginal necrosis of the wound	1 pt					
Wound dehiscence (intact fascia)	1 pt					
Wound dehiscence with affected fascia	4 pts					
Wound dehiscence with good granulation	1 pt					
Dehiscence with granulation but covered with fibers	2 pts					
Necrosis of the tissues	3 pts					

transfusion, guided by the values of the haemoglobin and the haematocrit (Figure 1).

Postoperatory blood loss was more frequent and more important quantitatively (Figure 2).

Blood loss correction was considered a compulsory procedure, because lower haemoglobin and haematocrit values can induce an aggravation of associated pathology in most of the patients.

Results

All 57 patients included in this study presented various predisposing factors for wound healing complications. All of them had previously at least one hip surgery, and 12 patients (21.05%) had more than one surgical intervention on the affected hip and an associated factor, consisting in the presence of infection. A total of 11 patients (11.29%) showed wound healing problems.

From the 12 patients with two-stage revision, in case of 4 patients (after the Girdlestone procedure or spacer implantation) the wound healing process was as presented in Table V.

Analyzing the presence of predisposing factors in case of the 11 patients we found:

Of the 57 patients with revision arthroplasty for various reasons, 11 patients (19.29%) have had various complications of the wound. It should be noted that among the 12 patients with hip reconstruction, 4 patients (33.33%)

Table IV. Wound healing complications in patients with revision hip arthroplasty

Wound healing complications	Number of cases
Secretion at the site of the drains	9
Secretion between the stitches	8
Wound swollen and hyperemic	4
Wound swollen, hyperemic and endured	2
Marginal necrosis of the wound	3
Wound dehiscence over the fascia	3
Wound dehiscence affecting the fascia	2
Wound dehiscence with good granulation	5



Fig. 1. Intraoperatory blood loss



Fig. 2. Postoperatory blood loss

had wound complication — a haematoma, due to highdose enoxaparine thromboprophylaxis. The haematoma causes secretion between the stitches and at the site of the drain, together with wound irritation. In these cases the treatment was as follows: haematoma evacuation, careful debridement, targeted antibiotic therapy based on previous bacteriological tests, and — if necessary — adjusted symptomatic treatment. In case of a residual haematoma, we also performed careful debridement, followed by secondary suture over a suction drainage system. The duration of parenteral antibiotic therapy was 14 days, after which we switched to oral administration.

Table V. Wound healing complications in patients with two-stage revision

Wound healing complications	Number of cases
Secretion at the site of the drains	4
Secretion between the stitches	4
Marginal necrosis of the wound	1
Superficial wound dehiscence	4
Deep wound dehiscence	4
Swollen and hyperemic wound	3



Fig. 3. Hospitalization period of patients with revision hip arthroplasty

In cases of patients with various wound healing problems the duration of hospitalization exceeded 12 days. We also noted the preponderance of cases hospitalized for at least 16 days, while in the cases that needed wound debridement and secondary suture, the hospitalization period was of 18 days or more.

Results monitoring was done by ambulatory determination of the values of the erythrocyte sedimentation rate (ESR) and C-reactive protein, which are usually used as markers of infection.

Patients were followed for 12 months, during which period they should not have any infectious complications at the surgical wound.

Discussions

A complication encountered during surgical healing may predispose to a $3.2 \times$ more frequent occurrence of bacterial periprosthetic complications, and if a residual haematoma is also present, this rate can increase to a value of $7 \times$ higher [1,2]. The most widely used definition of surgical wound infection is the following: the occurrence of infection signs at the site of the operation within 30 days of surgery, with a purulent drainage [3,4].

Superficial wound infections are infections that occur in a period of less than 30 days after surgery, and the infectious process involves only the skin or subcutaneous tissue in the incision line, with at least one of the following criteria also present: purulent drainage in the incision line, bacterial isolation (+) from the fluid or tissue samples. The following signs and symptoms are present: pain, tenderness, swelling, redness, increased local heat. In these cases the fascia lata is healthy.

Deep wound infections are those that occur within a 30 day period following surgery, if the implant is present for 12 months. The infection involves the deep soft tissues at the line of the incision and purulent drainage is present [5].

The diagnosis of superficial, incisional surgical site infection (SSI) can be made by the surgeon.

Classifications of SSI

The European Wound Management Association (EWMA) Classification 2005 [5]:

- ► Acute primary wound infection: cellulitis, pus/ abscess, delayed healing, erythema, induration, haemopurulent exsudate, wound breakdown, enlargement. Locally the skin may show: increased temperature, oedema, erythema with exudate, swelling, pain, tenderness.
- ► Acute secondary wound infection: cellulitis, pus/ abscess, delayed healing, erythema, induration, heamo-purulent exsudate, the volume of the exsudate permanently increased, malodor, wound breakdown, enlargement. The skin shows: discoloration, granulation tissue, easy bleeding, skin local temperature increased, tenderness, pain, oedema.

The Wansbeck Hospital Classification 2007 [6]:

- ▶ Grade 1. Wound discharge > 48 hours postoperatively.
- ▶ Grade 2. Antibiotics started on clinical grounds for wound problems (persistent discharge or clinical evidence of superficial infections).
- ▶ Grade 3. Patient returned to the operating theatre, wound debridement, multiple bacterial culture (–).
- ► Grade 4. Patient returned to the operating theatre, wound debridement, bacterial culture (+).

In every-day surgical praxis it is recommended to use a simple classification or scoring system. Still, at this moment there isn't a clear practical scoring system for this matter to be used in orthopaedic practice that would only be for orthopaedic use. The Asepsis and Southampton scores are adapted from general surgery [7].

Factors affecting wound complications after Čierny and Jones [8,9]:

- ► Type A: patients without predisposing factors for infectious wound complications;
- ► Type B: Comorbidities that act both as local and general factors in wound healing complications;
- ► Type C: Significant factors (carrier of bacteria) with other local factors (extended scars, lymphatic oedema, poor vascular perfusion, local fat tissue in excess) which together make a guarded or poor prognosis [9].

Factors most frequently identified in patients with surgical wound complication are diabetes mellitus with high blood glucose levels, the use of non-steroid anti-inflammatory drugs such as aspirin or ibuprofen, and corticosteroids by reducing the number of collagen cells at the wound site, and implicitly delaying the wound healing process [10].

Nutritional status also plays an important role in the wound healing process. Low blood levels of albumin, prealbumin and transferrin have a negative influence on this process. Also hypo-vitaminosis can create inconveniences, so all of these factors must be corrected before surgery. Albumin levels should be between 3.5–5.0 mg/dl, prealbumin between 10–40 mg/dl and transferrin between 200–400 mg/dl [10,11].

Thromboprophylaxis has a disputed role in wound healing complications. Some authors consider that the exact role of deltaparine in wound complications is still unclear [2]. There are some who consider these substances as a cause for postoperative seroma development, thus affecting wound healing [12,13].

Correction of intra and postoperative blood loss must also be performed. The calculation is based on the formula proposed by Sehat et al in 2004 [14]: total red blood cell volume loss = patient's blood volume (PBV) × (Hct preop – Hct postop). Blood transfusion also affects the wound healing process by means of immunomodulation [15,16].

A crucial factor is smoking, which affects the wound healing process in two ways: the vasoconstrictor effect significantly reduces blood irrigation of subcutaneous tissues and the carbon monoxide reduces haemoglobin values and tissue oxygenation [10]. Currently smoking is considered an essential factor to wound healing complications, because it increases complication rates by 12% compared to non-smoking patients [1,17].

An undiscovered septic source may cause bacterial colonization and surgical wound infection by dissemination [1,17]. Another possibility is contamination by air during surgery [6]. This can be prevented by proper antibioprophylaxis. This treatment reduced the rate of surgical wound infection from 3.3% to much smaller values, approximately 1–1.2% [18,19]. To be able to monitor the wound healing, it is recommended to measure skin temperature, given that an increase of local temperature of over 1.5°C is considered a warning sign [20]. Using suction drainage when suturing has a beneficial effect by not allowing secretions to stagnate and promoting the healing process by an improvement of blood circulation via the created vacuum effect [21,22].

Conclusions

We conclude that a per primam wound healing is a basic requirement in hip arthroplasty. Any change noted during wound healing should be treated very seriously. If it is necessary the wound will be opened immediately, careful debridement should be performed in association with bacteriological examination. Then, in the same stage or in a second stage, the wound should be anatomically reconstructed over a suction drainage system. Prophylactic antibiotics should be administered correctly, and if necessary targeted antibiotic treatment should be initiated. In our opinion, the use of cover type antibiotics in these cases has no indication.

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