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QUESTION 7: What are the risk factors predisposing a patient to surgical site infections (SSI) after spine surgery?

RECOMMENDATION: Numerous risk factors for SSIs following spine surgery have been identified, including diabetes, obesity, prior SSI, smoking, longer operative times, posterior approach to spine and the number of levels fused.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

The relatively low incidence of postoperative SSIs after spine surgery makes it challenging for studies to evaluate the risk factors for SSI in a prospective manner [1]. Based on our literature search, a number of retrospective studies and a single prospective study were identified. The findings of prior studies have also been summarized by multiple systematic reviews. Pull ter Gunne et al. performed a systematic review of 24 studies that identified risk factors for SSI after spine surgery [2]. All 24 studies were case-control and case series. There was a total of 73 potential factors evaluated, 34 of which were found to be significant in at least 1 study. There were 11 risk factors that were found to be significant in at least 2 studies. Among all risk factors, diabetes, obesity and prior SSI were the only three that were confirmed as risk factors by a multitude of studies.

Similarly, there was another systematic review which analyzed 36 observational studies for which 46 independent factors were studied [3]. Only six risk factors had been consistently proven to show an association with SSI after spine surgery, including diabetes, obesity, longer operative time, smoking, history of SSI and type of surgical procedure (i.e. tumor resection).

More recently, a prospective multicenter surveillance study was performed which enrolled 2,736 patients who underwent posterior thoracic and/or lumbar spine surgery [4]. Of these patients, 24 (0.9%) developed postoperative deep SSI. Preoperative steroid therapy, spinal trauma, male gender and prolonged operating time (> three hours) were found to be independent risk factors for SSI after spine surgery. Several previous retrospective studies have not identified preoperative steroid use and male gender as risk factors for SSI after spine surgery [2,5,6].

An ongoing prospective study funded by Pfizer evaluating the potential role of vaccination against *Staphylococcus* is likely to provide valuable information regarding the most important risk factors for SSI after spine surgery.

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Authors: Claus Simpfendorfer, Pouya Alijanipour, Caroline J. Granger

QUESTION 8: Should all patients with psoas abscesses be screened for both spine and hip infections?

RECOMMENDATION: Cross-sectional imaging with computed tomography (CT) and magnetic resonance imaging (MRI) will identify the source of secondary psoas abscesses in the majority of cases. If no other source is identified, consider cross-sectional imaging with CT or MRI for both the hip and spine in the setting of psoas abscess.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain 0% (Unanimous, Strongest Consensus)

RATIONALE

The iliopsoas is formed by two distinct and separate muscles - the psoas major and iliacus muscles. Each muscle is covered by its respective fascia and is typically associated with different disease entities [1]. The psoas major arises from the transverse processes of the lumbar vertebrae, exiting the pelvis beneath the inguinal ligament where it joins the iliacus (forming the iliopsoas tendon) and inserts on the lesser trochanter of the femur [2]. The iliacus muscle originates from the superior portion of the iliac fossa, superior lateral aspect of the sacrum and ventral sacroiliac and iliolumbar ligaments [2]. The medial portion of the iliacus muscle joins the psoas major tendon (forming the iliopsoas tendon) and inserts on the lesser trochanter. The lateral portion of the muscle inserts

directly on the anterior and anteromedial aspect of the femur below the lesser trochanter [3].

The literature often does not delineate between the two muscles, referring to the combined muscles as the iliopsoas or simply the psoas muscle. Making a distinction between these muscles can help determine the source of infection. With regards to musculoskeletal infections, the majority of psoas muscle abscesses reflect extension from an adjacent spondylodiskitis or septic facet [4–7]. In contrast, iliacus muscle abscesses are secondary to extension of an underlying hip infection through the iliopsoas bursa or infectious sacroiliitis.

The iliopsoas bursa is the largest bursa in the body and communicates with the hip joint in 14% of the population [8]. Communication of the joint capsule with the iliopsoas bursa is likely increased following hip arthroplasty [9]. With the majority of the bursa located deep in the iliacus muscle, hip joint infections typically involve the iliacus muscle alone or less often both the iliacus and psoas muscle [1,10]. When the psoas muscle is involved, there should be visible communication with a distended iliopsoas bursa. This is in contrast to the psoas abscess associated with spondylodiscitis, which does not involve the bursa.

Both lumbar spine osteodiscitis and septic hip arthritis can be associated with psoas abscess [11]. The spine as primary source of infection for secondary psoas abscess should always be included in the differential diagnosis [12]. Studies have reported that 10–36% of secondary psoas abscess is caused by disc infection [13,14]. The anatomical proximity and communication of the psoas muscle to the hip joint capsule creates a potential transit for bacterial spread from spine to the hip joint or vice versa [15]. Screening patients with a psoas abscess for both hip and spine infection can prevent this harmful infectious spread. However, it should also be considered that the infection may simultaneously result in multiple infection sites from the same original hematogenous source of psoas abscess or spinal infection.

A non-coincidental association exists between psoas abscess and hip infection, both in the virgin hip joint and in a prosthetic hip joint. There have been multiple reports regarding the progression of the extension of psoas abscesses into the virgin or prosthetic hip joints [16–19]. In one study, the percentage of prosthetic hip infections with associated psoas abscesses has been reported to be as high as 12% [19]. Hematogenous prosthetic infection and a medical history of neoplasm have been reported as risk factors of psoas abscess in patients with an infected hip replacement [19]. Psoas abscesses may also cause relapse of prosthetic hip infection.

It is recommended that practitioners screen patients with psoas abscesses for hip infection and spinal infection due to their anatomical communication, relationship in etiology and co-prevalence. Clinicians should be aware of the potential communication between the lumbar spine and hip joint via the psoas muscle and iliopsoas bursa. Successful treatment outcomes of psoas abscess are not only related to its early diagnosis, but also to the prompt detection of its spread to adjacent organs with potentially devastating outcomes, including the neural elements of spine and a prosthetic hip joint.

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1.5. PREVENTION: WOUND CARE

Author: Carles Pigrau

QUESTION 1: Is negative pressure wound therapy (NPWT) safe on spinal wounds in patients with a cerebrospinal fluid (CSF) leak?

RECOMMENDATION: NPWT may be harmful in patients with a CSF leak, leading to severe neurological sequelae.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 93%, Disagree: 7%, Abstain: 0% (Super Majority, Strong Consensus)