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THE RULE OF CT-GUIDED BIOPSY IN THE TREATMENT OF PYOGENIC SPONDOIYODISCITIS

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ABSTRACT

Background: Spondylodiscitis represents 2%–4% of all bone infection cases. The correct diagnosis and appropriate treatment can prevent complications such as vertebral collapse and spinal cord compression, avoiding surgical procedures. The diagnosis is based on characteristic clinical and radiographic findings and confirmed by blood culture and biopsy of the disc or the vertebra. Pyogenic spondylitis commonly occurs in adults in their fifth decade, and males are affected twice as often as females. The vertebral body and intervertebral disc are commonly involved. **Aim:** To compare the clinical and radiological improvement of the patients who were treated with empirical antibiotics and patients who underwent CT-guided biopsies followed by antibiotics according to the culture obtained by CT guided method. **Method:** This retrospective study was conducted at King Hussein medical Centre in Amman, capital of Jordan, from January 2016 to July 2019. Forty-seven patients with provisional diagnosis of spondylodiscitis were classified into two groups, group A who have a positive finding of the CT-guided biopsy. Group B with no pathogen identified due to negative result of the procedure or not performing it. Laboratory, radiological and culture findings were evaluated and IV antibiotics were commenced either empirically or according to CT-guided culture for both groups. **Conclusion:** CT-guided percutaneous biopsy of the spine is effective, simple procedure to evaluate suspicious spine lesions both in the case of malignancy and infection with a high accuracy rate and low risk of complications. It is essential to plan subsequent management and treatment of the patients.

KEYWORDS: Spondylodiscitis, CT-guided biopsy, Spine, Osteomyelitis.

1. INTRODUCTION

Septic spondylodiscitis is an infection involving the vertebral endplates and the intervertebral disks, which manifests by disabling pain, limitation of movements and might be complicated by neurological insult, and septicemia. Epidural space and the posterior elements of the spine, can all be infected.[1] With the development of the radiological modalities, the diagnoses of spondylodiscitis become easier, although misdiagnosis with other pathologies is still possible, such as degenerative changes, neuropathic arthropathy, multiple myeloma, or chordoma.[2]

Although infection can be confirmed by standard clinical, laboratories and imaging findings, detecting the causative pathogen is mandatory to initiate appropriate antibiotic therapy. CT-guided biopsy can be used to identify causative pathogens.[3]

Despite CT-guided biopsy of the spine is minimal invasive procedure; it may result in complications such as pain, neurological structures injuries, hematoma formation. Furthermore, it may fail to identify the pathogenic organism.[4]

In this study, we compare the clinical and radiological outcome between two groups of the patients; those who causative microorganisms were identified on CT-guided biopsy and those who causative microbes not identified due to causes as failure of the procedure, inadequate biopsy, no pathogens, and those did not tolerate the procedure.

2. METHODS

2.1 Clinical history

This is a retrospective single center study was conducted at Royal rehabilitation center at king Hussein medical city in Amman, capital of Jordan, from January 2016 to July 2019. All patients who were admitted to spine department with provisional diagnosis of spondylodiscitis were divided into two groups; group A: patients who underwent CT-guided biopsy and group B;

patients who did not have culture secondary to failure of the procedure or not doing it or negative results of biopsy. The causes of not performing the procedure include non-cooperating, comorbidities and inability to lay prone position.

Forty-seven patients (20 women, 27 men) with clinical and radiological findings suggestive of spondylodiscitis were included in the study. Group A includes 32 patients and group B include 15 patients. Sociodemographic characteristic and their comorbidities were recorded.

2.2 Radiological findings

Spondylodiskitis provisional diagnosis based on clinical and imaging evaluation. MRI findings suggesting infection were defined as edema or contrast-enhancement of the intervertebral disk, adjacent vertebrae, epidural and paravertebral space. An abscess was defined as iso- or hypointensity compared to muscle tissue on T1-weighted images, fluid-equivalent signal intensity on T2-weighted images, and rim enhancement on contrast-enhanced T1-weighted fat saturated images, figure 1.[5]

Fig.1: Left: Sagittal STIR image showing increased signal in the intervertebral disc space, due to fluid in the space, with mild marrow edema in the bodies. Right: Sagittal STIR image from another patient showing increased signal in the intervertebral disc space with a minimal fluid collection.

2.3 Laboratories workup

Laboratories workup includes full blood count, and inflammatory markers as Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP).

2.4 The biopsy preparation and procedure

The involved disk level and the approach were defined according to pre-interventional MRI. All patients received local anesthetic agent (xylocaine) 5-10 mg diluted with saline in the skin at the site of entry with a true-cut needle and at the track and the periosteum and the disc space.

A thin-slice planning CT scan (0.75 mm slice thickness) was done in the prone position, and multiplanar reconstructions were used to non-traumatically position the biopsy needle. A small skin incision was made, and a biopsy was performed using a 3.0 mm (11 gauge) or 4.0 mm (8 gauge) biopsy system (Bone Marrow Biopsy Needle), figure 2.

A transpedicular or posterolateral approach was used in all patients. If abscesses were founded, additional aspiration of the liquid content was performed. A biopsy sample was sent for microbiological examination, and an additional sample was sent for histopathological examination.

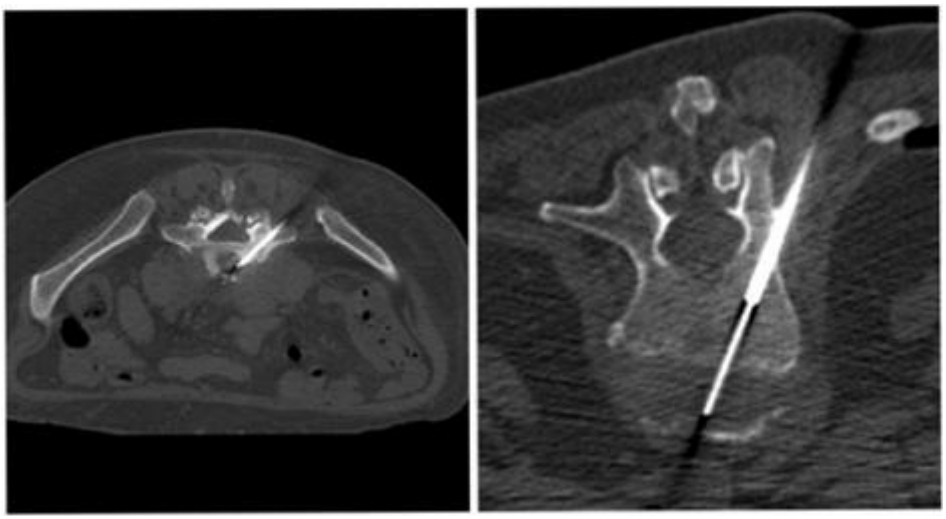

Fig. 2: CT-guided biopsy demonstrating the biopsy needle penetrating into disk space.

2.5 Failed biopsy and empirical treatment for negative results

There is wide agreement that empirical antibiotic therapy should only be initiated once the pathogen has not been detected [6]. In patient who did not underwent the procedure and in cases with cases with culture-negative spondylodiscitis and patients who underwent the procedure and waiting the culture, antibiotics that cover the most common pathogens (especially *S. aureus*, streptococci, and *E. coli*) was administered according to our institute culture and sensitivity protocol. When deciding on antibiotics and oral administration, one also needs to take bioavailability and bone penetration into consideration in the course of treatment.

2.6 Surgical decompression

Surgical interventions were decided in the following conditions: neurological deficits, sepsis, presence of significant intradural collection, vertebral translation more than 5 mm, failure of conservative therapy, segmental kyphosis more than 15° and vertebral body collapse more than 50%.

3. RESULT

Out of forty-seven patients included in the study, 32 (68%) patients underwent CT-guided biopsy. The mean age for the study group was 57.5 years. The lumber spine was the most commonly affected (38 patients, 80.9%). The thoracic spine was affected in the remaining nine (19.1%) patients. In this study, the most commonly involved sites was the L4-L5 level, followed by L3-L4, D12-L1, L5-S1, L1-L2, and L2-L3.

Diabetes mellitus was identified in 15 patients, renal failure in 2 patients, one patient has history of renal transplantation and another one had underlying malignancy. Leukocytosis was detected in 23 (48.9%) patients and ESR was elevated in 42 (89.4%) patients and anemia was detected in 17 (36.2%) patients.

Causative pathogens were detected in twenty-two (68.8%) patients out the first group who underwent CT-guided biopsy. Staphylococci was detected in 10 patients, one being methicillin resistant. Escherichia coli was identified in 4 patients, Brucella in 3 patients, Enterobacteria in 2 patients and Pseudomonas and mixed growth in one specimen each.

Histological analysis revealed inflammatory signs in 28 patients out of 32. Acute inflammation was found in 21 patients and chronic inflammatory process in 7 patients. Nonspecific finding was found in four samples. No malignancy was detected in any sample.

4. DISCUSSION

The incidence of pyogenic spondylodiscitis is around 1:250,000, which represents around 3% to 5% of osteomyelitis as a whole. Staphylococcus. aureus is the most common pathogen (about 30%-80%), 2% to 16% of which are reported to be Methicillin Resistant S. aureus, followed by gram-negative *E. coli*, which accounts for 5% to 30%.[7] The results in our study was comparative where *S. aureus* accounted for about 45.24%; gram-negative *E. coli* accounted for 16.65%, and MRSA was found in 4.76% of the cases.

Most patients presented in this study had local back pain and tenderness with a rise in inflammatory parameters like ESR, CRP. ESR is a sensitive marker for infection but lacks specificity; it may be elevated in over 90% of cases, with mean elevation ranging from 43 mm/h to 87 mm/h. C-reactive protein (CRP) is similarly raised in the large majority of cases with spondylodiscitis [8]. Maus et al. reviewed 29 successfully treated patients, CRP had returned to normal in all survivors at three months follow-up.[9] Some authors suggest that CRP is the preferred marker for monitoring response to treatment. The leucocyte count is the least useful amongst the inflammatory markers; it is high in only a third to half of affected patients.[10] Immunocompromised patients and those aged over 60 years were more likely to have a

normal white cell count. However, age did not appear to affect leucocyte count.[11,12] Approximately 70% of patients with spondylodiscitis may be anemic.[13]

Successful isolation of microorganism varies from author to another, it ranging from 50 – 75%. Ahuja et al. reported 57.8% successful rate[14], while in Kasalak study it was 31.3%[15] and 14.3% in Czuczman review.[16] In our review the pathogens were isolated in 68.8 %. Nevertheless, positive cultures allow administration of pathogen sensitive antibiotic which may reduce conservative treatment failure.

The aim of spondylodiscitis treatment is to eradicate the focus of infection, prevent spinal instability, prevent neurological insult, and reduce pain. Identifying the causative microorganism of spondylodiscitis is mandatory to initiate appropriate antibiotics. The principles of conservative treatment are to establish an accurate microbiological diagnosis, treat with appropriate antibiotics, immobilize the spine, and closely monitor for spinal instability and neurological deterioration. The purpose of surgical treatment is to obtain multiple intraoperative cultures of bone and soft tissue, perform a thorough excision of infected tissue and decompression of neural structures, and reconstruct the unstable spinal column with concomitant instrumentation. Appropriate management requires aggressive medical treatment and simultaneously surgical interventions. If recognized early and treated appropriately, a full recovery can often be expected.

Our study had several limitations. It has to be clearly stated that this is a retrospective study based on a relatively small patient group from a single center. This study does not intend to inform clinical decision-making on an individual basis. Therefore, the presented results should not be used to finally judge about performing or not perform CT-biopsies in spondylodiscitis cases without further confirmatory validation studies. Prospective studies with larger patient cohorts performed in different centers are needed to confirm our findings. These prospective studies might also include a multivariate analysis to investigate the weighting and interaction of each factor and predict the likelihood of having positive microbiology. We did not calculate every possible variable combination that might be associated with positive or negative biopsy yields; thus, other combinations might also be helpful in decision making.

False-positive microbiological results due to contamination with non-pathogen germ contamination cannot be ruled out with absolute certainty; however, they seem very unlikely in a scenario where clinical presentation, laboratory findings, and imaging features are all concordant with spondylodiscitis.

5. CONCLUSION

CT-guided percutaneous biopsy of the spine is an important tool in the evaluation of suspicious spine lesions both in the case of malignancy and in the case of infection with a high accuracy rate and low risk of complications. It is essential to plan subsequent management and treatment of the patients. Regardless the success of the procedure, it may yield negative culture. However, this should be interpreted in the contexts of the clinical scenario.

6. ETHICAL APPROVAL: This study was approved by the Ethics Committee of the Jordanian royal medical services.

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