Percutaneous biopsy in suspected infective discitis

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Introduction

Infective discitis is an inflammatory process involving the intervertebral disc space, often related to infection. It is a rare condition with an incidence of between 0.4 and 2.4 per 100,000 each year in the western world. There is a bimodal age distribution with the first peak in childhood and the second peak around the sixth decade. The lumbar spine is affected in up to 60% of cases, followed by the thoracic and cervical regions. Clinical presentation is often insidious and, therefore, delay in diagnosis for up to six months is not uncommon. Most patients complain of back or neck pain. Fever is present in up to two thirds of patients. In the majority of patients, the inflammatory markers (eg C-reactive protein) will be raised.

The most common micro-organism isolated is staphylococcus aureus, implicated in 15-84% of non-tuberculous cases. This is followed in frequency by Gram negative bacilli (E.coli, proteus and enterococci). Tuberculous spondylodiscitis is often seen in the immunosuppressed, alcoholics, intravenous drug users and immigrants from sub-Saharan Africa, South East Asia and the Indian subcontinent. S. aureus is also the most commonly isolated pathogen in discitis, complicating invasive spinal procedures. Streptococci are frequently seen in association with a dental port of entry or endocarditis.

In most cases, there is usually a preceding history of infection in the skin, soft tissues, genitourinary, respiratory and gastrointestinal tracts. From these sites, haematogenous spread of micro-organisms occur to the vertebral bodies. The organisms are deposited in the end-arterial arcades of the vertebral body metaphysis, resulting in bony ischaemia and infarction. The vertebral endplates are frequently involved and the infection may extend to involve the paraspinous soft tissues, the epidural space and adjacent vertebral bodies.

Imaging

Plain radiographic findings of infective discitis are not apparent until 2-8 weeks after the initial symptoms. Findings on plain radiographs include narrowing of the disc space, indistinct vertebral endplates and loss of height of the affected vertebral bodies (figure 1). There may also be an abnormal psoas shadow, mediastinal widening or retropharyngeal space enlargement, signs suggestive of paraspinous soft tissue involvement. Absence of these features, however, does not exclude the diagnosis.

CT findings highly suggestive of infective discitis include anterior paravertebral soft tissue swelling with obliteration of paravertebral fat planes, fragmentation or erosions of vertebral end plates and paravertebral fluid collections (figure 2). MRI is the most sensitive (93-96%) and specific (92.5-97%) modality for diagnosis of discitis. It provides better definition of the paravertebral and epidural spaces and allows assessment of neural element compression. It may be able to differentiate between early post-operative fibrosis and infection. The initial inflammatory response to discitis involves bone marrow oedema. Features of infective discitis seen on MRI include:

(a) Increased signal intensity of the disc and vertebral body on T2-weighted images;
(b) Endplate and disc enhancement with Gadolinium contrast;
(c) Presence of paraspinal or epidural inflammation. Epidural and soft tissue abscesses are readily seen on T2-weighted images and post-contrast sequences.

General principles

Percutaneous biopsy is defined as the removal of tissue from a living body with the aim of establishing a precise diagnosis either by microscopic examination or tissue culture. Image-guided percutaneous biopsy has become a useful alternative to traditional open surgical biopsies. The imaging modalities used to facilitate percutaneous biopsy in suspected discitis include computed tomography (CT), fluoroscopy (figures 5) and magnetic resonance (MR) imaging.

The main advantages of image-guided biopsies over open surgical biopsies include:

- Avoidance of general anaesthesia
- Lower cost
- Minimal recovery time
- Minimal soft tissue injury
- Biopsy of surgically inaccessible sites

The contra-indications to biopsy include a known bleeding diathesis, decreased platelet count, suspected vascular lesion at biopsy site, soft tissue infection at the biopsy site, inaccessible sites and an unco-operative patient.

A recent study of CT-guided biopsies in suspected discitis reported a yield of 36%. Several other studies report diagnostic rates of between 49% and 78%. A reason frequently cited for this wide range in diagnostic yield is the effect of recent antibiotic usage. Nevertheless, percutaneous image-guided biopsy has gained popularity as the procedure of choice.

At our institution, CT is the imaging modality of choice for guiding biopsy of lesions in the spine. All imaging is completed and reviewed alongside clinical data prior to biopsy. Anticoagulants are discontinued and antibiotics are generally withheld for at least 48 hours before the procedure. Premedication and/or conscious sedation with anxiolytics such as Midazolam may be considered.

Patient preparation

Patient positioning is crucial and will be based on the planned needle access route. Another equally important factor to be considered is patient comfort on the gantry. For thoracolumbar lesions, the patient is usually positioned prone. Less frequently, the patient may have to lie in the lateral decubitus position to optimise patient comfort and minimise patient movement.

A CT scan is performed to localise the lesion precisely. An appropriate slice is selected to plan the ideal route for guiding the needle into the lesion. Generally, if there are multiple lesions, the largest and most superficial lesion is chosen. In addition to the disc, the adjacent subchondral bone should also be biopsied as this is the site of origin of haematogenous discitis. In planning the path of the biopsy needle, vital neurovascular and visceral structures should be avoided.

The approach to be adopted depends on the exact site of the lesion, must take into account the proximity of neurovascular bundles and be appropriately tailored for each patient. So far as possible, transgression of uninvolved tissue compartments should be avoided. The depth and angle of the chosen needle path should be estimated or measured on the most appropriate CT image. The entry point on the patient’s skin can either be estimated or, alternatively, a grid of radio-opaque skin markers can be used. The selected slice is surface marked, and the skin cleaned and draped. Following local anaesthetic (Lidocaine 1%) infiltration, a small skin incision is made and the biopsy needle is advanced into the lesion under intermittent CT guidance. For lesions in the thoracolumbar spine, the posterolateral...
paravertebral (figures 1 and 4), transpedicular (figure 7) and transcostovertebral approaches are used.

The accuracy rates of transpedicular and posterolateral approaches are similar. A lateral approach can be used to access the lumbar vertebral body, disc and any paravertebral collections. The patient is positioned in the lateral decubitus position. In this position, the abdominal viscera are displaced forwards, providing a safe path towards the lateral aspect of the lumbar spine. The advantage of this approach is that the needle tip is directed away from the nerve roots.

Biopsy technique and needles

A large variety of needles with a range of sizes are commercially available and the type used depends on the nature of the lesion and the operator's personal preference. In general, the needle selected should be long enough to reach the lesion and have the appropriate bore size to obtain an adequate amount of specimen. Ideally, a needle should be placed into different parts of the lesion to ensure representative sampling. The needles can be grouped into aspiration (eg spinal needle or 22 gauge Chiba needle) or cutting (eg tentative sampling. The needles can be grouped into aspiration (eg spinal needle or 22 gauge Chiba needle) or cutting (eg Temno biopsy needle) needles. Aspiration needles have a fine gauge and are best used to aspirate fluid (figure 6), soft tissue lesions or disc contents for culture (figure 1) or cytology.

Occasionally, a coaxial technique may be required. This technique has the advantage of obtaining two or three samples through a single tract for better diagnosis. All samples should be sent for cytology, culture and histopathological examination. CT-guided needle aspiration has been found to be accurate for identifying active bacterial disc infections. Adding histopathological analysis to microbiological analysis improves the sensitivity of identifying infective lesions. The labelling and dispatching of samples should be done carefully and promptly.

Following the procedure, the biopsy puncture site is dressed and observed for possible complications. The duration of the post-procedure observation period is variable and depends mainly on the amount sedation administered. Written post-procedural instructions are routinely made available to medical staff caring for all patients returning to the ward.

Complications

Complications from percutaneous spinal biopsies are rare but have been described. The reported incidence rates range between 0 to 10%, with serious complication rates being less than 1%. The most frequently reported complications include bleeding, needle breakage, biopsy site infection, neurological injury and pneumothoraces. Risks for image-guided biopsy are acknowledged to be less than those associated with surgical open biopsy under general anaesthesia. The types and incidence of complications depend on the type of needle used and on the anatomical location of the lesion.

Conclusion

Image-guided percutaneous biopsy is a safe and well-tolerated procedure that has a useful role in the diagnosis of infective discitis. Careful attention to technique and awareness of the potential limitations of this procedure are key factors in ensuring a high diagnostic yield.

References


FIGURE 1
(a) Lateral lumbar radiograph shows irregular narrowing of the L2/3 disc space. The endplates appear indistinct and there is mild anterior wedging of the adjacent vertebral bodies. (b) Axial CT image performed in the prone position shows an 18-gauge spinal needle being inserted into the L3 superior subchondral vertebral body via a right posterolateral paravertebral approach. A grid of skin markers was used in this case to mark the most appropriate skin entry point.
FIGURE 2
(a) Sagittal MPR reformatted image shows collapse and destruction of the T9/10 disc and adjacent vertebral endplates with fragmentation of the inferior half of the T9 and superior half of the T10 vertebral bodies. (b) There is minimal anterior paraspinal soft tissue thickening. Appearances are consistent with T9/10 infective discitis.

FIGURE 3
(a) Sagittal T2 STIR image of the lumbar spine demonstrates hyperintensity of L5 and S1 consistent with bone marrow oedema, destruction of adjacent end plates, anterior subligamentous and posterior epidural extension. Appearances are typical of L5/S1 infective discitis. (b) Axial T1-weighted image shows L5/S1 infective discitis with extension into the right facet joint associated with a right psoas and epidural abscess.

FIGURE 4
CT-guided biopsy of the L4/5 disc via a posterolateral paravertebral approach with a 13-gauge bone biopsy needle in a patient lying in the prone position. CT image shows the tip of the needle within the right side of the disc.

FIGURE 5
Fluoroscopic-guidance of a percutaneous disc biopsy for suspected infective discitis. A right posterior oblique approach through the T12-L1 disc was used in this case.
FIGURE 6
(a) Sagittal T2 STIR image shows established discitis at T6/7 with destruction of the vertebral endplates and a substantial disc and paravertebral abscess collection. There is a shallow epidural abscess indenting the theca without cord compromise. (b) Axial CT image of the same case shows bilateral paravertebral abscesses at the T6/7 level. An 18-gauge spinal needle was advanced over the posterosuperior surface of the right seventh rib. Approximately 150ml of normal saline was infiltrated superficial to the parietal pleura in order to create space to advance the needle into the abscess cavity from which a sample was aspirated.

FIGURE 7
Axial CT image shows that the bevelled-point stylet of this Temno cutting biopsy needle has been advanced into the disc in preparation for firing of the cutting cannula. In this case, the operator decided to perform the procedure with the patient lying in the lateral decubitus position using the transpedicular approach.