Abstract

Purpose. Psoas abscesses are the most frequent complication of tuberculosis with skeletal involvement. The aim of this paper is to report our experience with the systematic application of percutaneous drainage to tuberculous psoas abscesses.

Materials and methods. Between January 1997 and December 2005, 23 patients (14 men and nine women; age range 21–48 years), after a previous study with computed tomography (CT) and/or magnetic resonance (MR) imaging, underwent percutaneous drainage of a tuberculous fluid collection in the psoas muscles. Follow-up consisted of monthly clinical and laboratory assessment, and plain chest radiography and spinal CT every 6–12 months.

Results. Spondylodiscitis involved the thoracolumbar spine. Fluid collections were bilateral in 14 cases and communicating in ten of these. Maximum transverse diameter was 7 cm, whereas longitudinal diameter was 14 cm. Placement of the drainage catheter was successful in all cases, and the catheter was left in place for 5–36 (mean 18.4) days. Symptom regression occurred immediately after drainage of the fluid collection. The drainage procedure was curative in 100% of cases. Dislodgement of the drainage catheter occurred in two cases as a result of excessive traction during dressing removal.

Conclusions. A serious complication of bone tuberculosis, psoas abscesses can be effectively treated by percutaneous drainage, leading to immediate pain resolution. The

Riassunto

Obiettivo. Gli ascessi dei muscoli psoas rappresentano la complicanza più frequente della malattia tubercolare con localizzazione ossea. Scopo del lavoro è riportare la nostra esperienza nell’applicare sistematicamente il drenaggio percutaneo a tali raccolte fluide.

Materiali e metodi. Tra gennaio 1997 e dicembre 2005, 23 pazienti (14 uomini e 9 donne), di età compresa tra i 21 ed i 48 anni, precedentemente studiati con TC e/o RM, sono stati sottoposti a drenaggio percutaneo di una raccolta fluida, di origine tubercolare, localizzata nei muscoli psoas. Il follow-up è consistito in una valutazione clinica e di laboratorio mensile, una radiografia diretta del torace e una TC della colonna ogni 6–12 mesi.

Risultati. La spondilodiscite era localizzata a livello dorsale e lombare; le raccolte erano bilateral in 14 casi: di queste, 10 erano comunicanti. Il massimo diametro trasverso è stato di 7 cm, mentre quello longitudinale è stato di 14 cm. Il posizionamento del catetere di drenaggio è sempre avvenuto con successo, con una permanenza del catetere di 5–36 giorni (media 18,4 giorni); la regressione della sintomatologia è avvenuta già all’atto dell’evacuazione della raccolta fluida. Il drenaggio è risultato curativo nel 100% dei casi. Abbiamo registrato la dislocazione del catetere di drenaggio in 2 casi, per eccessiva trazione dello stesso, durante le fasi della medicazione.

Conclusioni. Gli ascessi dei muscoli psoas rappresentano una seria complicanza nella localizzazione ossea della
drainage catheter requires daily monitoring to identify when it can be safely removed without risk of recurrence.

**Keywords** Tuberculosis · Psoas abscess · Percutaneous drainage

**Introduction**

Despite the systematic use of targeted therapy and serial laboratory testing, tuberculosis continues to be a major cause of morbidity and mortality, affecting more than 30 million people worldwide, especially in developing countries where hygienic conditions are poor [1–3]. Although past prevention and treatment strategies decreased its frequency in Western countries [2], recent trends in alcohol and drug abuse, the rising numbers of HIV and AIDS cases [4] and waves of migration from the Third World have led to a resurgence of the disease in developed countries as well [5].

In addition to primary and secondary pulmonary manifestations, tuberculosis may also affect the skeletal system, which is the most frequent extrapulmonary localisation [3]. In particular, the thoracic and lumbar vertebral bodies and intervertebral discs are common sites of involvement, and the formation of paraspinal tuberculous abscesses is seen in approximately 50–75% of cases of bone tuberculosis [1, 3].

The clinical diagnosis of tuberculous abscesses is not easy, as the symptoms have indolent onset and gradual progression owing to the slow course of tuberculosis. Very often, patients present with inexplicable lumbar pain or motor deficit in the lower limbs [5]. Diagnostic suspicion can be confirmed with computed tomography (CT) [6] or magnetic resonance (MR) imaging [7, 8], as both diagnostic modalities are able to document changes in the margins, size and density of the psoas muscles before and after contrast administration.

Whereas conservative management (analgesics, immobilisation, external orthoses) was the mainstay of treatment in the past, with surgery reserved for patients not responding to conservative treatment [9] and with disease in other anatomical regions [10], today, percutaneous drainage is increasingly being used to treat the fluid collections [4, 9, 11].

The systematic application of percutaneous drainage has been rarely described in the literature, and the few existing reports are limited to small patient series. We describe our short- to mid-term experience with percutaneous drainage of tuberculous psoas abscesses in a reasonably sized group of patients.
Materials and methods

Over a period of 7 years, 62 patients with psoas-muscle fluid collections were treated with percutaneous drainage at our centre. The abscess proved to be tuberculous in 23 of them, and these formed the basis of our study. The patients, 14 women and nine men, age 21–48 (mean 39) years, had been admitted to different respiratory disease divisions of our hospital because of the gradual onset of nonspecific symptoms such as worsening fatigue, persistent mild evening fever, productive cough at times with blood-tinged sputum, and pain in the thoracic spine in nine patients and in the lumbar spine in 14. Only four patients also presented with gait disorder and an inability to stay upright. In two cases, the symptoms appeared during pregnancy and worsened during breastfeeding. Pain had been partially controlled with analgesics and in three cases even with the occasional addition of opiates.

Diagnostic tests revealed the presence of a lung lesion on plain chest radiography or on subsequent CT scan (16 active lesions, seven sequelae), as well as associated findings at the level of the spine and psoas muscles. These destructive lesions were subsequently further investigated with CT and/or MRI. CT was performed on 16 patients with a conventional CT scanner (Rhota CTW 950 SR, Esaote Biomedica, Genoa, Italy) and a protocol consisting of a study of the spine with a slice thickness of 5 mm before and after contrast administration (Optiray 300, Tyco Healthcare Spa, Milan, Italy). MR imaging was performed on seven patients using a 1.0-T magnet (Siemens, Erlangen, Germany) and sagittal and longitudinal T1-weighted sequences before and after contrast administration (Magnevist, Schering, Berlin, Germany) and T2-weighted spin-echo sequences (repetition time ms/echo time ms, 500–600/15–20 and 2,000/90, respectively).

A fluid collection or abscess was defined as a well-delimited, uni- or multilocular space-occupying swelling in soft tissue with a hypodense central area and peripheral contrast enhancement on CT (Fig. 1), or as a lesion showing T1 hypointensity and T2 hyperintensity and surrounded by a capsule on MR imaging (Fig. 2). All lesions not exhibiting these features were considered to be solid inflammatory tissue (granulation tissue). Abscesses were considered appropriate for percutaneous drainage if they met the following criteria [7]: abscesses associated with spondylodiscitis, larger than 3 cm in diameter, causing pain refractory to systemic antituberculous chemotherapy, and associated with altered laboratory parameters (neutrophil leukocytosis, elevated erythrocyte sedimentation rate). Exclusion criteria were identification of paravertebral or paraspinal granulation tissue associated with a hypodense fluid collection, or epidural location of the fluid collection with spinal cord compression. These patients were referred for surgery.
In the 23 patients selected for percutaneous drainage, the choice of imaging guidance was based on abscess location and its visibility at sonography (Technos MPX, Esaote Biomedica, Genoa, Italy) and used as the initial guidance modality (Fig. 3a). Sonography was the first-choice \[\text{zione occupante spazio nei tessuti molli, ben definita e delimitata, uni o pluriconcamerata, con una zona centrale ipodensa e rinforzo periferico dopo somministrazione di MdC alla TC (Fig. 1), oppure una lesione ipointensa in T1 ed iperintensa in T2, circondata da una capsula nello studio di RM (Fig. 2). Le lesioni prive di questa caratteristica sono state definite come tessuto infiammatorio solido (tessuto di granulazione). Gli ascessi venivano considerati appropriati per un drenaggio percutaneo secondo indicazioni già riportate da altri autori [7], che brevemente riassumiamo: dovevano essere associati ad una spondilodiscite, dovevano avere dimensioni superiori ai 3 cm di diametro, con una sintomatologia dolorosa che non aveva tratto beneficio dalla chemioterapia antitubercolare sistemica, con la presenza di un’alterazione dei parametri di laboratorio (leucocitosi neutrofila, aumento della VES). I criteri di esclusione sono stati il riconoscimento di un tessuto di granulazione paravertebrale o paraspinale associato con una raccolta fluida ipodensa, o la localizzazione epidurale della raccolta, con compressione midollare. Tali pazienti sono stati avviati alla soluzione chirurgica.}

Nei 23 pazienti avviati al drenaggio percutaneo, la scelta della guida radiologica è stata effettuata sulla base della localizzazione dell’ascesso e sulla maggiore o minore visibilità di questi all’ecografia (Technos MPX, Esaote Biomedica, Genova, Italia), effettuata quale primo momento della procedura interventistica (Fig. 3a). Tale ultima tecnica è stata comunque impiegata sempre in prima istanza per le caratteristiche di maggiore rapidità e visibilità in tempo...
modality because it is faster and provides real-time monitoring throughout the drainage procedure. CT guidance was chiefly used for paravertebral and anterior localisations, where sonographic visibility was limited by the presence of bowel gas.

Percutaneous drainage was performed with the Seldinger technique after obtaining the patients' informed consent. With the patient in prone position, the skin was disinfected and local anaesthesia applied. A small incision was made with a straight no. 11 scalpel. The initial puncture was performed under sonographic guidance with a 15-cm-long 18-gauge needle (HS SpA, Aprilia, Rome, Italy) inserted into the most distal portion of the fluid collection. The fluid was aspirated with a 10-ml luer-lock syringe to confirm the position of the needle and guide the choice of drainage catheter based on the texture of the caseous material. If the material was easily aspirated, an 8-Fr drainage catheter was selected (Fig. 3b), otherwise, a larger catheter was preferred. Subsequently, after the injection of contrast material (Optiray 240, Tyco Healthcare Spa, Milan, Italy) to demonstrate the extent of the collection and exclude fistulous communications, a stiff, 0.038”, 80-cm-long J-tip hydrophilic guidewire was inserted (Terumo Corporation, Gamma International, Rome, Italy). After dilation with a 7-Fr fascial dilator (Kimal, Uxbridge, UK), an 8/10-Fr, 35-cm-long pigtail catheter was placed and secured to the skin (Flexima APDL, Boston Scientific, Spencer, USA) (Fig. 4). The more laborious Seldinger technique was preferred to the Trocar technique to spare the patient further trauma and pain resulting from the wider bore of the catheters used in

Fig. 3a,b Sonography prior to the interventional procedure with transducer oriented towards the lower pole of the ipsilateral kidney shows a 2.8x5-cm hypoechoic mass with homogeneous and well-defined margins in the left paravertebral region (a). Owing to good lesion visibility, sonographically guided drainage was performed with an 8-Fr pigtail catheter with multiple terminal holes (b).

Fig. 3a,b Ecografia. L’indagine ecografica propedeutica alla procedura interventistica, in sede paravertebrale sinistra, con sonda orientata verso il polo inferiore del rene omolaterale, mostra la presenza di una formazione ipoecogena, a margini omogenei e ben definiti, delle dimensioni di cm 2,8 per 5 circa (a). Grazie alla buona visibilità della lesione viene eseguito il drenaggio ecoguidato, con posizionamento di catetere pig tail 8 Fr, a fori multipli terminali (b).
the one-step Trocar technique. All purulent material was aspirated, and part of it was sent for bacteriological testing.

All catheters were left to drain by gravity and were flushed at least three times daily with 100 ml of saline solution injected through 20-ml luer-lock syringes. The catheters were also used for the local injection of antituberculotics (rifampicin, 600 mg). Catheters were left in place until the daily yield of inflammatory exudate ceased or decreased to <10 ml per day on at least 3 consecutive days. These conditions coincided with a substantial clinical improvement, blood chemistry with no evidence of inflammation, radiographic findings of collection regression (Fig. 5 a–d) or CT scans demonstrating almost complete abscess resolution (Fig. 6). Follow-up consisted of monthly sputum analyses and laboratory testing for Mycobacterium tuberculosis and 6-monthly spine CT and plain chest radiography.

Fig. 4 Percutaneous drainage. Radiography after catheter placement shows the characteristics of the catheter (placed inside the largest portion of the abscess, which is able to drain the more cranial exudate by gravity thanks to the multiple lateral holes in the rolled-up portion of the catheter, a configuration that makes it nontraumatic) and of the drained collection.

**Risultati**

Tutti i pazienti, tranne uno, erano stranieri. La localizzazione della spondilodiscite, accertata con la TC e/o con la RM, era a livello dorso lombare, mentre nessuno ha fatto registrare localizzazioni sacrali. La distruzione localizzata di uno o più corpi vertebrali era visibile in tutti i pazienti: 3/21 avevano il coinvolgimento di un solo corpo vertebrale, 16/21 di due corpi vertebrali e 4 di tre corpi vertebrali.

Tutti i pazienti sono stati sottoposti al drenaggio percutaneo in associazione con la chemioterapia sistemica (rifampicina 600 mg, isoniazide 300 mg, etambutolo 1250 mg, pirazinamide 1500 mg) e loco-regionale (rifampicina 600 mg). La procedura interventistica è stata eseguita in 16 casi con un’assistenza ecografica e in 7 casi con la guida alla cute (Flexima APDL, Boston Scientific, Spencer, USA) (Fig. 4). Si è preferito impiegare la più indaginosa tecnica di Seldinger, e non la Trocar, per evitare ulteriori traumatismi e dolori al paziente, visto l’ampio calibro del catetere necessario ad eseguire il drenaggio in prima battuta. Tutto il materiale purulento è stato aspirato; parte è stato inviato per le ricerche batteriologiche.

Tutti i cateteri sono stati lasciati drenare per gravità: sono stati lavati quotidianamente con 100 ml di soluzione fisiologica, almeno tre volte al giorno, impiegando siringhe “luer lock” da 20 ml; inoltre sono stati utilizzati anche per l’iniezione di farmaci anti-tubercolari in loco (rifampicina 600 mg). Sono stati tenuti in sede fino a che la produzione giornaliera di materiale infiammatorio non è cessata o è risultata inferiore a 10 ml giornalieri per almeno 3 giorni consecutivi. Tale situazione ha coinciso con il sostanziale miglioramento clinico del paziente, con i reperti ematochimici che confermavano l’assenza dell’inflammazione, oppure i controlli radiologici documentavano la regressione della raccolta (Fig. 5), oppure con una TC che documentava la pressoché completa risoluzione della cavità ascessuale (Fig. 6). Il follow-up è consistito in una ricerca mensile del Mycobacterium tuberculosis, attraverso l’esame dell’espettorato ed accertamenti di laboratorio, e in una valutazione radiologica semestrale con la TC della colonna e la radiografia diretta del torace.
Results

All patients but one were immigrants. In all cases, spondylodiscitis involved the thoracolumbar level, as demonstrated by CT and/or MR imaging. There were no cases of sacral localisation. Localised destruction of one or more vertebral

TC. Il posizionamento del catetere di drenaggio è avvenuto con successo in tutti i casi, indipendentemente dalla tecnica di assistenza radiologica impiegata. Sono stati posizionati sempre, in prima istanza, cateteri di drenaggio 8 Fr; si è fatto ricorso sistematicamente alla tecnica di Seldinger, per evitare il traumatismo diretto di un catetere con calibro
bodies was seen in all patients, with involvement of only one vertebra in 3/23 patients, two vertebrae in 16/23 and three vertebrae in 4/23.

All patients had an associated abscess in either one or both psoas muscles: six were unilateral on the right side, three unilateral on the left and 14 bilateral; ten were communicating abscesses. Abscess size varied: the largest transverse diameter, 7 cm, was seen in a lumbar abscess, probably because of greater severity, whereas the smallest transverse diameter, 3.7 cm, was seen in a thoracic abscess (mean 5.3 cm). The largest longitudinal extension was 14 cm, whereas the smallest was 6.3 cm (mean 9.8 cm).

All patients underwent percutaneous drainage combined with systemic chemotherapy (rifampicin 600 mg, isoniazid 300 mg, ethambutol 1,250 mg, pyrazinamide 1,500 mg) and locoregional chemotherapy (rifampicin 600 mg). The interventional procedure was performed under sonographic guidance in 16 cases and CT guidance in seven cases. The drainage catheter was successfully placed in all cases independently of the modality used for guidance. All procedures were carried out with 8-Fr drainage catheters as a first choice, and the Seldinger technique was used systematically to avoid any direct trauma being caused by the large-bore catheters used with Trocar technique.

We observed no major complications and only two minor complications: in two patients, the catheter became dislodged due to excessive traction during daily catheter care and had to be replaced with a larger (10-Fr) drainage catheter inserted via the existing pathway. No patient, including those with pulmonary recurrence, necessitated surgical drainage due to inefficacy of the procedure, so that percutaneous drainage proved curative in 100% of cases.

elevato, che avremmo avuto con la tecnica Trocar.

Non si sono avute complicanze maggiori, ma solo 2 minori: in due pazienti si è resa necessaria la sostituzione dei cateteri per una loro dislocazione a seguito di eccessiva trazione durante l’effettuazione di una medicazione giornaliera: in tali pazienti è stato posizionato un nuovo catetere di drenaggio, di dimensioni maggiori (10 Fr), utilizzando il tramite preesistente. In nessuno dei pazienti, compresi quelli con recidiva polmonare, si è dovuto ricorrere a drenaggio chirurgico per inefficacia dell’atto interventistico, per cui il drenaggio è risultato curativo nel 100% dei casi.

Il periodo di drenaggio è stato 5–36 giorni (media 18,4 giorni), con un sensibile miglioramento della sintomatologia già nelle prime fasi di posizionamento del catetere ed è proseguito nei giorni successivi. Il batterio tubercolare è stato isolato in 18 dei 21 ascessi dei muscoli psoas, mentre negli altri la diagnosi è stata indiretta, basata cioè sui reperti della contemporanea localizzazione polmonare e sui reperti radiologici della colonna vertebrale.

Durante i primi 12 mesi del periodo di controllo, ben 19 pazienti si sono presentati regolarmente, sottoponendosi sia agli esami di laboratorio sia ai controlli radiografici, mentre 4 non sono risultati più reperibili. Mentre tutti erano guariti per la spondilodiscite e le raccolte ascessuali, solo un paziente ha fatto registrare la ripresa della malattia polmonare per una resistenza all’isoniazide, per cui si è resa necessaria la somministrazione di una differente associazione di farmaci antitubercolari.

Discussione

Lo scheletro, e principalmente la colonna vertebrale, risulta coinvolto nel 3% dei casi di localizzazione extrapolmonare
Drainage duration was 5–36 (mean 18.4) days. There was a significant improvement in symptoms immediately after catheter placement, and this continued over the following days. The tuberculosis bacterium was isolated in 18 of the 23 psoas abscesses, whereas in the remainder, the diagnosis was reached indirectly on the basis of findings of the simultaneous involvement of the lung and spine.

Nineteen patients regularly attended for laboratory and imaging testing during the first 12 months of follow-up, whereas four were lost to follow-up. Whereas the spondylodiscitis and abscesses had resolved in all cases, one patient had recurrence of pulmonary tuberculosis due to isoniazid resistance, leading to a treatment change.

Discussion

The skeleton, and particularly the spine, is involved in 3% of cases of extrapulmonary tuberculosis. *M. tuberculosis* can reach the spine through haematogenous spread, with embolisation to a site distant from the primary focus, or through direct extension from contiguous foci of infection (rarely); no cases of venous dissemination or direct seeding during surgery or interventional radiology procedures have been reported [12, 13].

Spondylodiscitis starts in the inferior and anterior portion of the vertebral body, at the level of the metaphysis, which has a rich arterial supply. Septic embolisation causes bone infarction and is followed by a granulomatous inflammatory reaction. The inflammation spreads to the entire vertebral body along the medullary canals and to adjacent vertebrae along the longitudinal anterior ligament, with delayed disc involvement due to the lack of specific cartilage proteolytic enzyme in *M. tuberculosis* [6, 13]. Disc involvement leads to destruction and collapse of the vertebral body, resulting in severe spinal deformity.

Abscess formation is caused by the spread of the vertebral disease to neighbouring areas. With no obstacles blocking its path, the disease may extend to the spinal cord canal posteriorly and/or the retroperitoneum and psoas muscles anteriorly and laterally. The retroperitoneum is divided into compartments by fasciae. However, because many of its compartments are not completely covered by septations, they may potentially become open and act as a route for disease dissemination, allowing spinal infection to spread. Abscesses may often give rise to nonspecific symptoms, including claudication, or may mimic an osteolytic lesion. The size of the abscess appears to depend on the amount of fat displaced by the inflammatory process or fluid collection [14].

Although a final diagnosis of tuberculous abscess requires specimen cultures to confirm the presence of the bacterium, cultures often prove positive in only
50–60% of cases. Consequently, as reported by other authors [15], the diagnosis of tuberculosis is at times presumptive and based on clinical presentation and imaging findings at onset and following response to antituberculous treatment.

With regard to therapy, the use of antituberculous drugs combined with bed rest and physical therapy have significantly improved clinical outcomes, although a full functional recovery will take a long time. In the past, surgery was principally used in the case of unsatisfactory results of conservative management, spinal deformity or spinal instability secondary to pathological fractures, and neurological symptoms: anterior decompression, drainage, and debriement with posterior fusion have represented the mainstay of the surgical approach, with mortality rates ranging from 2% to 11% and recurrence rates between 10% and 20% [16, 22].

The technique of percutaneous drainage appeared in the 1980s to 1990s. Performed under local anaesthesia with the aid of an imaging technique, it aims to promote abscess resolution without operative intervention [23]. Widely and successfully employed in other anatomical regions [11], percutaneous drainage under sonographic or CT guidance may also be used in tuberculous abscesses of the psoas muscles to help accelerate healing with full remission of symptoms. Whereas CT is superior to sonography in depicting the location and extent of the abscesses and their relations with neighbouring organs and in suggesting the most appropriate route for catheter insertion [6], sonography has the advantage of being faster and enabling real-time monitoring of the entire procedure. The choice between the two techniques will depend on lesion location and operator preference [11].

Percutaneous drainage of a fluid collection includes various phases: locating the fluid collection, choosing the path to follow and placing one or more catheters [23]. In consideration of the clinical situation, the imaging findings of extensive vertebral destruction and of abscess formation in the psoas muscles, all patients in our series underwent complete evacuation of the infected collection and never diagnostic aspiration only. The final drainage catheter was chosen according to the exudate characteristics, with 8-Fr catheters being used in all cases given that the exudate appeared moderately dense at initial needle puncture [9]. In addition, our decision took into account the traumatic nature of the procedure in subjects already suffering severely and unable to tolerate placement of larger-bore catheters under local anaesthesia alone. For these reasons, we avoided the Trocar technique. The greater laboriousness of the Seldinger technique is offset by the lower level of pain endured by the patient during the procedure.

The choice of percutaneous drainage catheter proved optimal in terms of resolution of the clinical symptoms in
both unilocular and multilocular abscesses. Pain decreased significantly as soon as the needle was inserted and the fluid collection started to be aspirated, making subsequent placement of the drainage catheter less painful. Clinical symptoms improved significantly and constantly over the following days. Generally, placement of a single drainage catheter for each fluid collection was sufficient. Bilateral and communicating abscesses were treated with the double drainage technique to allow the passage of the smaller fluid collection to the larger one and help close the communication between the two abscess cavities. Drainage was curative in 100% of patients. We had no cases of partially curative drainage, that is, requiring surgery for underlying problems or fistulas, which demonstrates the effectiveness of this procedure. These results are in line with other authors’ experiences [17–19].

There were no major complications (septic shock, bacteremia, haemorrhage, bowel transgression, pleural transgression) or minor complications (except for catheter dislodgement during dressing removal). We had no cases of abscess recurrence, which may occur in the event of resistance to antituberculous medication (in endemic areas, resistance to isoniazid is 4%), incorrect diagnosis (tuberculous abscess misdiagnosed as bacterial abscess), early cessation of systemic antituberculous medication (therapy should continue for at least 12 months) and presence of large abscesses extending to different areas, not all drained by the catheter [15, 17]. Furthermore, the chronic nature of tuberculous spondylitis and the persistence of a active tuberculous focus in the spine after catheter removal may also be responsible for recurrence [5]. Consequently, we decided to combine locoregional and systemic therapy for the duration of the drainage procedure to increase medication concentration at the tuberculous infection site. This explains in part the absence of recurrences in our limited experience.

**Conclusions**

Psoas muscle abscesses are not infrequent occurrences in clinical practice, given the continuing population migration towards Western countries, including Italy. Percutaneous drainage of these fluid collections, if performed by experienced operators, carries a low risk of morbidity and is much less traumatic than the surgical approach. Percutaneous drainage requires daily care of the drainage catheter (flushing with saline solution) and monitoring over time to ascertain complete abscess resolution and patient recovery. Percutaneous drainage is curative in 100% of cases.
Conflict of interest statement The author declare that they have no conflict of interest to the publication of this article.

References/Bibliografia


Author queries
1. Should there be an institution or affiliation (hospital) in the corresponding author’s address?
2. In Results section, the total number of patients indicated 21: “3/21 patients, two vertebrae in 16/21 and three vertebrae in 4/21”; and later in the section “in 18 of the 21 psoas abscesses”? This has now been changed to a total of 23. Please check
3. Refs. 16–21 are not in numeric order. Please check and renumber all references and citations in numeric order of appearance.

Domande agli autori
1. Le voci bibliografiche 22 e 23 sono citate in ordine sbagliato e le 20 e 21 non vengono mai citate nel testo. Verificare