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Discitis in young children

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Discitis is uncommon in children and presents in different ways at different ages. It is most difficult to diagnose in the uncommunicative toddler of one to three years of age. We present 11 consecutive cases. The non-specific clinical features included refusal to walk (63%), back pain (27%), inability to flex the lower back (50%) and a loss of lumbar lordosis (40%). Laboratory tests were unhelpful and cultures of blood and disc tissue were negative.

MRI reduces the diagnostic delay and may help to avoid the requirement for a biopsy. In 75% of cases it demonstrated a paravertebral inflammatory mass, which helped to determine the duration of the oral therapy given after initial intravenous antibiotics.

At a mean follow-up of 21 months (10 to 40), all the spines were mobile and the patients free from pain. Radiological fusion occurred in 20% and was predictable after two years. At follow-up, MRI showed variable appearances: changes in the vertebral body usually resolved at 24 months and recovery of the disc was seen after 34 months.

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Discitis is a rare condition which is often difficult to diagnose. It is an infection or inflammation of the intervertebral disc space or vertebral endplate.[1,2] Discitis in childhood has been separated into three age groups with different presentations, namely the neonate, the toddler (one to three years) and the older child.[3] Figure 1 shows the age distribution of cases of discitis reported in the literature in which ages were given.[1,2,4,5] These large series included heterogeneous groups of children of all ages collected over several decades.[1,2] Discitis in the toddler age group is the most difficult to diagnose because these children are unable to give a history and may be unco-operative. The increased blood supply to the endplate in the younger child may explain the difference in the clinical features at different age groups.[6] We present the clinical, radiological and MRI findings, and the results at follow-up from a consecutive series from a supraregional referral centre.

Patients and Methods

We studied 11 consecutive patients, diagnosed between 1993 and 1998, with a mean age of 19 months (14 to 36). The diagnostic criteria for discitis were positive clinical findings, radiological narrowing of the intervertebral disc space or MRI changes which included a loss of disc height, an abnormal disc signal with destruction of the endplates or protrusion of the disc.

All patients received intravenous broad-spectrum antibiotics for an inital period of two weeks, with either a combination of amikacin and piptazobactam or amoxicillin and flucloxacillin, followed by an oral regime of either augmentin, cefuroxime alone or flucloxacillin and amoxicillin for a further variable period of two weeks to six

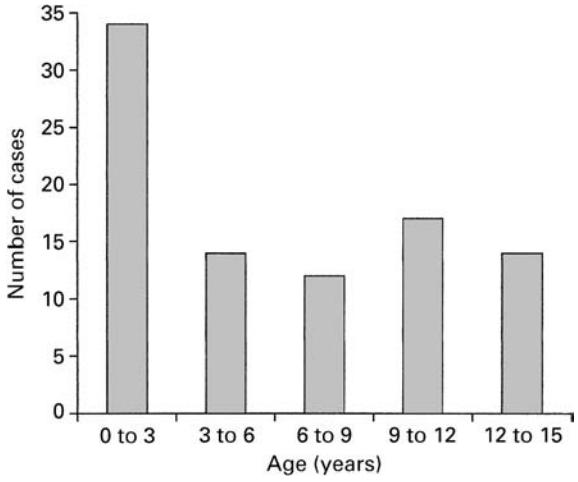

Fig. 1

An analysis of the age at presentation from the major series of childhood discitis reported in the literature which published the ages of their patients. There is a peak at both the toddler and later childhood groups.

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months. All patients had a negative Mantoux test and 45% wore a spinal brace for a mean of 11 weeks (2 to 26). No patient required surgery.

The case notes and imaging were reviewed and the children seen at a follow-up clinic when a further lumbar radiograph was taken and MRI performed, if the parents gave consent. For statistical analysis between the groups, with and without MRI, we applied Student's *t*-test.

Results

Clinical features. There were seven girls and four boys with a mean age at diagnosis of 19 months (14 to 36). The level most commonly involved was the L3/4 disc, followed by the L5/S1 disc. The presenting clinical features are summarised in Table I.

The mean duration of symptoms before attending hospital was 24 days (7 to 56). The mean interval between attendance and a correct diagnosis was ten days (1 to 28). This was 7.6 days for patients who had MRI, compared with 16.6 days for those without, which was statistically significant ($p = 0.08$).

The initial diagnosis was incorrect in six cases (54%). These included three with disease of the spinal cord and one each of tumour, an irritable hip, and vertebral osteomyelitis. Initial presentation to an orthopaedic surgeon led to the exclusion of abnormality of the hip, and referral to a paediatrician was followed by neurological investigations.

Biochemical studies. The mean ESR was 47 mm/hour (17 to 100). It was greater than 20 mm/hour in 80% and rose above 50 mm/hour in 40% of the patients. The level of C-reactive protein was normal in 60% (<0.3 mg/dl) and between 0.3 and 2 mg/dl in 40%. The white cell count was normal in 36% with a mean of 11 900 per mm^3 (8900 to 20 300).

Blood was taken for culture in all patients before they received antibiotics. Three had a biopsy of the disc space, in two by CT guidance and in one by an open technique. Two biopsies contained only inflammatory cells and the third was normal. The paravertebral inflammatory masses in three patients were also biopsied, two by CT guidance and one using ultrasound. All the tissue biopsies and the blood cultures were sterile.

Table I. The clinical features of discitis in the toddler, as a percentage

Symptom		Sign	
Limp, hip or leg pain (refusal to walk)	63	Coin test*	50
Back pain	27	Loss of lordosis	40
Pain-free limb weakness	9	Paraspinous muscle spasm	20
Fever	0	Gibbus	18
Abdominal pain	0	Neurological signs	9
		No classical signs	27

* the 'coin test' demonstrates an inability to flex the lower back, assessed by placing an object, such as a coin (or a sweet), on the floor and asking the child to pick it up[3]

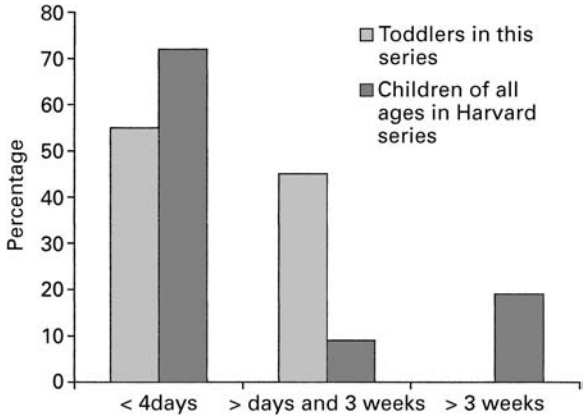

Fig. 2

Analysis of the percentage of cases in each group, divided according to the duration of symptoms after commencing intravenous antibiotics. All the children had recovered within three weeks.

Imaging. Various imaging techniques were used. Anteroposterior and lateral radiographs showed narrowing of the disc space in six patients, but in four the radiographic appearance was normal at presentation. One child, seen by a neurologist, had MRI without a lumbar spinal radiograph.

A ^{99m}Tc bone scan was performed in four patients, which confirmed the diagnosis in only one; the other three required further imaging.

At presentation, eight children were investigated by MRI, using spin-echo T1 and T2 sequences, all with gadolinium enhancement, performed on a 1.5 Tesla superconducting magnet (Siemens Magnetron SP4000 or a Siemens Vision; Siemens plc, Bracknell, UK). This was diagnostic in all cases. The disc signal was abnormal on the T2-weighted images in all eight patients. An abnormal signal in the marrow of the adjacent vertebral bodies was seen in six patients. Pathological gadolinium enhancement within the disc and adjacent vertebral body was seen in all children. A paraspinal inflammatory mass was present in 75%. No intraspinal or epidural abscesses were seen.

Recovery. The system described by Ring, Johnston and Wenger[7] was used to study the duration of symptoms after commencing intravenous antibiotics. Group 1 is defined as having relief within four days, group 2 within three weeks and group 3 with a prolonged duration (> three weeks) or a recurrence, readmission or surgical intervention. Figure 2 compares our patients with those of Ring et al,[7] which included children of all ages. All our patients had become asymptomatic within three weeks of starting intravenous antibiotics.

Those in whom symptoms persisted after beginning medication had a more lengthy interval between the initial onset of symptoms and starting treatment. The interval for group 1 was 28 days compared with 43 days for group 2.

There was no correlation between outcome, the severity of presentation or the use of a spinal brace.

Follow-up studies. After three months, most children were

still asymptomatic, but one had a mild painfree kyphosis and a second had started to walk with an unsteady gait which resolved after one year.

The nine children who remained in the UK were reviewed clinically at a mean of 21 months (10 to 40). They were all free from pain, with mobile spines, no deformity and no neurological abnormality.

In two, the disc height was fully restored on the radiographic examination at review. In six there was a loss of less than 25% of disc height with persistent sclerosis of the endplates. Two patients with a loss of between 25% and 50% of disc height showed early osseous fusion at 20 months. The vertebral body had developed posterior wedging in one patient and a forward slip between L5 and S1 was seen in another. Due to the reluctance of the parents to consent to sedation, MRI was performed at follow-up in only five children.

Discussion

The results of our study show that the clinical course of discitis in a toddler is often insidious with a gradual onset. The presentation is typically late, with few pathognomonic clinical features. Diagnosis is often delayed with few helpful laboratory investigations. The plain radiographs may be normal or show only subtle abnormalities. The early use of MRI can significantly reduce this delay.

The literature contains several large series of children with discitis at differing ages, which has added to the confusion concerning the aetiology of the condition. Many authors recognise at least three distinct age groups affected by discitis, namely the neonate, the toddler and the early teenager.[8-10] To our knowledge we have described the largest series dealing only with the toddler age group. The clinical differences may be explained by the anatomy of the disc in the young, in which there are arterioles in the cartilage canals of the developing vertebral endplate.[6] The vertebral blood supply undergoes involution from richly anastomotic intraosseous arteries communicating with the disc in the fetus, infant and preschool child, to the end arteries seen in the adolescent and adult. This copious blood supply could predispose to an infective agent settling in the disc and could also explain the usual good recovery and lack of long-term damage in the toddler.

In this series there was a mean delay of 24 days before seeking medical attention. The commonest presenting complaint was refusal to walk, with limping and hip or leg pain, which was seen in 63%. Back pain is the most common symptom in all age groups. A breakdown of the results collected by Crawford et al,[9] over a period of ten years, however, showed a similar frequency of refusal to walk in 70% of toddlers. No child in our series presented with fever or abdominal pain, which are the more common features of presentation in the teenager.[9]

Inability to flex the lower back and loss of lumbar lordosis were the most common clinical signs in our cases. The presentation may be subtle, as indicated by the lack of any classical signs in three cases (27%).

One child presented with lower motorneurone signs of limb weakness, reduced tone, and absent reflexes. This is rarely reported in other series. MRI enhanced by gadolinium showed localised inflammatory tissue posterior to the disc which surrounded the spinal nerves (Figs 3b and 3c).

The mean ESR was raised significantly, but only above 50 mm/hour in 40%. The level of C-reactive protein was not greater than 2 mg/dl; the laboratory upper limit of normal was <0.3 mg/dl. These tests had low sensitivities and were unhelpful. Their main use is in monitoring the response to treatment. Previous studies of all age groups have shown that white cell counts are frequently normal or only slightly raised, and that the ESR is usually only moderately raised, at between 20 and 80 mm/hour.[1-3]

None of our patients had evidence of fever or systemic toxicity. All blood cultures were negative, but it has been suggested that they are most useful in patients with relatively acute symptoms, especially in children older than

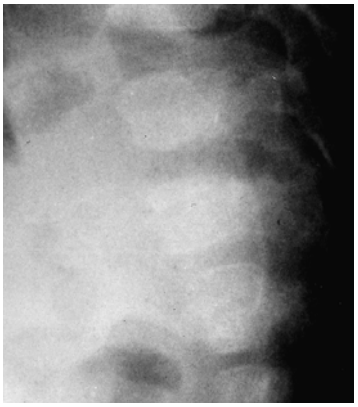

Fig. 3a

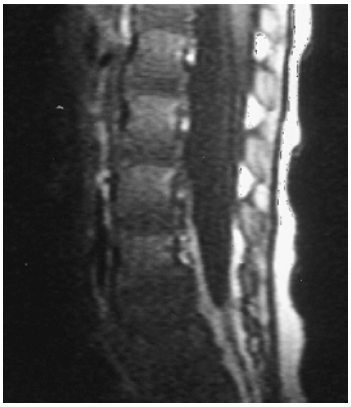

Fig. 3b

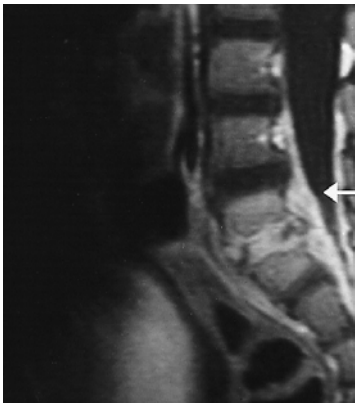

Fig 3c

Imaging at presentation of a 14-month-old child with a two-week history of refusal to walk. The lateral plain radiograph was reported as normal (a). T1-weighted sagittal MRI before (b) and after (c) gadolinium enhancement shows localised diffuse inflammation (arrow) around the spinal nerves at the L5 and S1 levels, in addition to enhancement of the L5/S1 disc space and the adjacent vertebral bodies.

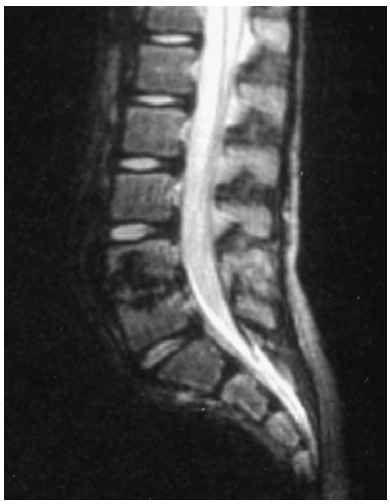

Fig. 4

T2-weighted MRI showing deposition of haemosiderin manifesting as a low T2 signal in the L5/L6 disc and adjacent vertebral bodies 29 months after presentation (L6 is an extra lumbar vertebra).

eight years with fever, or with an ESR above 50 mm/hour.[1,3]

Gram-positive cocci, especially *Staphylococcus aureus*, are the organisms most commonly isolated from both the blood and from cultures of disc tissue. However, in our series all cultures from biopsies of the disc were sterile. The literature reports variable rates of culture for disc biopsies in children of all ages with discitis, with a positive rate of culture between 0% and 67%.[9,11] In the two large series of patients of all age groups studied by Wenger et al[1] and Speigel et al,[2] a pathogen was cultured in 67% (6 of 9) and 27% (4 of 15) of cases, respectively. This is evidence of a probable microbial cause for discitis, but in only one series of 16 children of all age groups was a routine operative biopsy performed.[12] The cultures were all negative, but histological examination confirmed inflammation in ten and normal tissue in five, which raised the question of a different aetiology.

The precise aetiology of discitis remains unclear. Most authors suggest that it is an infective process,[1,2,9] but non-infective processes and trauma have also been suggested.[12] The reasons for failure to culture a pathogen may be either a brisk host-defence response to a low-grade pathogen which significantly reduces the number of bacteria in the disc tissue, an artefact from inadequate sampling, or improper collection of the specimens.

We discourage both open and needle biopsies of the disc in the toddler because of a low rate of culture, the negligible influence on the choice of antibiotic regime and the unknown long-term effects of the procedure. On MRI we have seen deposition of haemosiderin within a disc which may have been produced by an open biopsy performed 29 months earlier (Fig. 4).

If MRI confirms changes within the disc space, a biopsy is not required. This should be reserved for patients not responding to intravenous antibiotic therapy in whom tuberculosis, fungal or other infections are suspected, and in those who are immunocompromised.

Some centres, unlike ours, do not routinely prescribe antibiotics, but recommend analgesia and a spinal support for a child without signs of systemic toxicity and with a low ESR. To determine the role of intravenous antibiotics in this condition would require a prospective, multicentre, randomised, controlled trial. The retrospective multicentre study by Ring et al[7] demonstrated a statistically significant decrease in the duration of symptoms for a child treated with intravenous antibiotics compared with oral or no antibiotics.

The duration of oral therapy is also controversial and variable.[3] In our patients it ranged from two weeks to six months with a mean of three months. We recommend a longer period of oral therapy for toddlers with slow onset, prolonged diagnostic delay or an extensive paravertebral inflammatory mass identified by MRI.

Good imaging is essential for the diagnosis of discitis in the preschool child. Radiographs of the lumbar spine may show loss of disc height and irregularity of the endplates. These, however, may be normal until three to eight weeks after the onset of symptoms. In our series, radiographs of four children were reported as normal at a mean of three weeks after the onset of symptoms (Fig. 3a). The six patients with radiological changes had a mean duration of symptoms of five weeks, but all required further imaging to confirm the diagnosis (Figs 5a and 5b).

A ^{99m}Tc bone scan, which can be positive within one week of the onset of symptoms,[2] has been shown to be a safe method for diagnosing infection of the disc space.[1] Four of our patients had a bone scan, but three required further imaging, since a ^{99m}Tc bone scan cannot differentiate discitis from other causes of back pain.

The first reported use of MRI in a child with discitis was in 1986.[13] Over the last decade, the availability of MRI has increased substantially. Eight of our patients (72%) had MRI at presentation which was diagnostic in all and helped to differentiate between discitis, vertebral osteomyelitis and pathology of the hip or spinal cord. T1-weighted MRI with gadolinium contrast can demonstrate abnormal enhancement of the disc and the adjacent parts of the vertebral bodies and can differentiate between a paravertebral inflammatory mass and an abscess (Fig. 6a). T2-weighted MRI shows a loss of disc height, an abnormal disc signal and irregular vertebral endplates (Fig. 6b). The benefits of MRI outweigh the low risks of sedation in this age group.

The early use of MRI reduced the delay between presentation to hospital and diagnosis from 16.6 to 7.6 days. The children who recovered within four days had a mean time from the onset of symptoms to treatment of 28 days, whereas in those with a longer recovery, but less than three

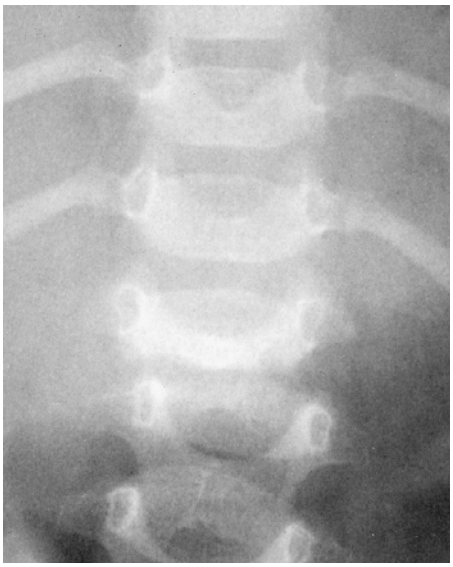

Fig. 5a

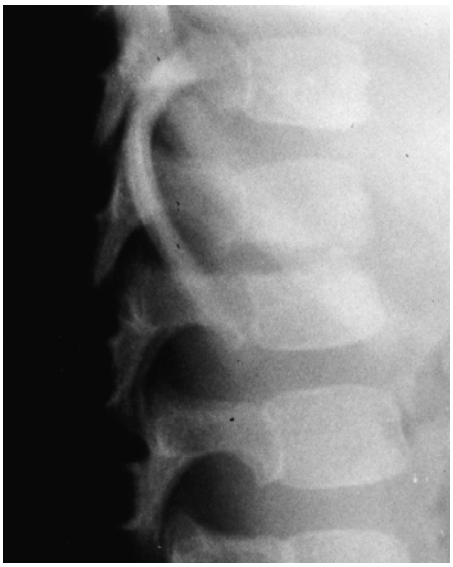

Fig. 5b

Anteroposterior (a) and lateral (b) plain radiographs of a 17-month-old child with a two-week history of refusal to walk, showing loss of height of the L1/L2 disc and irregular endplates.

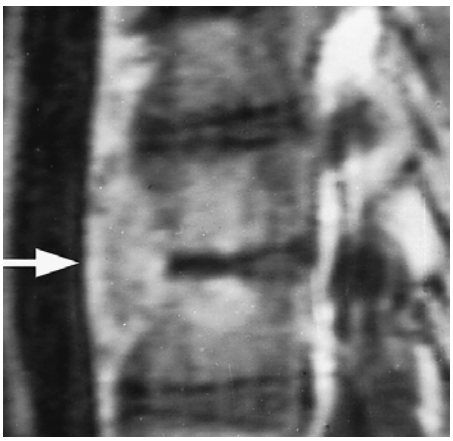

Fig. 6a

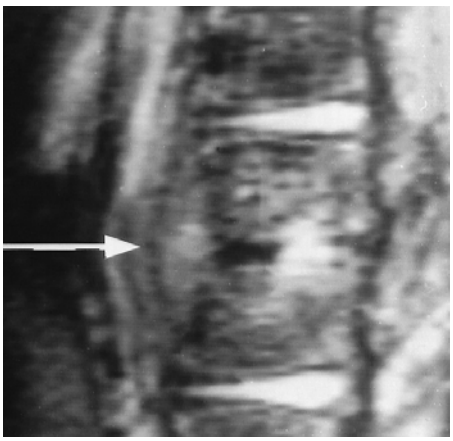

Fig. 6b

Figure 6a – T1-weighted sagittal MRI after gadolinium enhancement showing loss of disc height, abnormal enhancement in both vertebrae, irregularity of the endplate and altered signal within the vertebral bodies. Figure 6b – T2-weighted MRI showing reduced disc signal. An anterior prevertebral inflammatory mass is best seen on the T1-weighted image (arrow).

weeks, it was 43 days. This suggests that early diagnosis aids recovery and avoids lengthy hospitalisation.

MRI also allows visualisation of possible local complications which may require surgical intervention, such as severe protrusion of the disc with nerve-root entrapment or a widespread paravertebral abscess. Six of the eight (75%) patients who had MRI at presentation had a paravertebral inflammatory mass. These have previously been reported,[14] but we are unaware of any publication describing the incidence of paravertebral abscesses seen on MRI. We believe that they are more common than was recognised before MRI was introduced. No mass required open drainage, or was detectable on the follow-up MRI. The presence of a paravertebral mass suggested more advanced inflammation and we therefore treated these patients more aggressively with a longer duration of oral antibiotic therapy.

The radiographs at follow-up showed that most disc spaces had persistent endplate sclerosis, with a loss of less than 25% of the disc height. Those which had lost more than 50% went on to fusion. In our limited series, these two outcomes could be distinguished two years after treatment. The overall rate of fusion was 20%. The literature for children of all ages contains few descriptions of the rates of fusion, which vary widely from 14% in the series of Wenger et al[1] to 44% in that of Speigel et al.[2] We suggest that the low rate of fusion in toddlers may be due to good healing capacity as a result of the rich local blood supply.

We would not recommend routine MRI at follow-up,

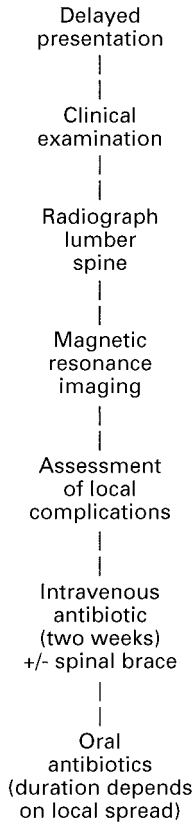

Fig. 7

Algorithm showing the management of discitis in the toddler. Biopsy of the disc is usually unhelpful and is not recommended (see text).

because of parental reluctance to give consent for the essential sedation, and the lack of influence on future management. After a mean of 23 months (15 to 29), the hypointense areas of the vertebral bodies had improved, but the disc continued to show a reduced signal on T2-weighted images, and the loss of disc height persisted. Disc recovery was slower. In the patient with a 34-month follow-up the disc had almost fully recovered in signal on all MR sequences. This is consistent with the suggestion by Fischer[3] that re-expansion of the disc space will take at least one to two years.

We strongly advocate the early use of MRI to confirm rapidly the diagnosis of discitis and to determine which toddler may require orthopaedic management (Fig. 7). This may require early transfer of patients to regional paediatric centres with experience of this uncommon condition.

No benefits in any form have been received or will be received from a commermcial party related directly or indirectly to the subject of this article.

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