Severe granulomatous arthritis due to spinous injury by a "sea mouse" annelid worm

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Abstract

A case of destructive arthritis and soft tissue granulomatous inflammation occurred in a 25 year old man who had injured his right index finger while snorkelling in the Mediterranean. It was initially thought that he had fallen on a sea-urchin. He removed some spines at the time of injury but the finger became stiff, swollen, and painful, and after eight months with no symptomatic improvement amputation through the proximal phalanx was performed. Examination showed an exuberant granulomatous and foreign body type inflammation in the dermis and subcutaneous tissues and affecting the bone, with erosion of the cartilaginous surfaces of the proximal interphalangeal joint. Spines present in soft tissue sections contained no calcium but did contain chitin as shown by a von Wisseling reaction for chitosan.

It is concluded that the chitinous spines almost certainly came from a sea-mouse (*Phylum Annelida*, family *Aphroditidae*). Sea mice are inconspicuous creatures which live on the sea floor and which may cause some injuries thought to be attributable to sea-urchins.

One of the rarer hazards of sea bathing and water sports, particularly in the Mediterranean, are injuries from the spines of sea-urchins (*Phylum Echinodermata*, class *Echinoidea*). Serious and chronic sequelae at the site of injury have been previously reported including sarcoid-like granulomata both within the soft tissues and also in bone.¹⁻⁴ Destructive arthritis is a known complication. In some cases associated systemic illness occurs. We report a case of a hand injury, initially thought to have been caused by a sea-urchin, in which subsequent investigation by light microscopy, electron microscopy, x-ray microanalysis and a von Wisseling reaction for chitosan showed that the spines were almost certainly from a type of marine annelid worm, called a "sea mouse".

Case report

A 25 year old man injured his right index finger while snorkelling in the Mediterranean in 1988 and claimed that he had fallen on a sea-urchin. He was able to remove seven of

eight spines from the finger. The finger became stiff, functionless, and extremely painful and, six months later, when first seen as an outpatient, there was fusiform tender swelling of the finger and pronounced limitation of flexion. There was no symptomatic improvement and surgical exploration showed severe inflammation and articular erosions of the proximal interphalangeal (PIP) joint. An amputation was performed through the proximal phalanx eight months after the original injury. At this time a small spine was found in the soft tissue on the palmar aspect of the finger.

Methods

The whole excised finger was fixed in phosphate buffered formalin⁵ and conventionally embedded in paraffin wax. Sections (5 µm) from soft tissue and decalcified blocks were stained with haematoxylin and eosin for light microscopical examination.

Material selected from soft tissue sections for electron microscopy was dewaxed, rehydrated back to buffer, post-fixed in 1% (w/v) cacodylate buffered osmium tetroxide, dehydrated in a graded series of alcohols and embedded in Agar 100 resin (Agar Scientific). Semithin (1 µm) sections stained with toluidine blue were examined by light microscopy before ultrathin sectioning on a Reichert OMU4 Ultracut ultramicrotome. Sections were collected on 200 mesh copper grids, stained with uranyl acetate and lead citrate, and examined in an AEI EM801 electron microscope.

For analytical electron microscopy, dewaxed soft tissue blocks containing spinous material were embedded and sectioned as above but without osmication. Sections were collected on to both copper and nickel grids coated with pioloform. These were examined in an AEI Cora analytical electron microscope.

A spare unstained wax section was used to determine the presence of chitin in the spines by the von Wisseling test,⁶ which shows the presence of chitosan, a breakdown product of chitin. The section was dewaxed, rehydrated, and covered with 60% potassium hydroxide. After a coverslip had been added the slide was heated strongly over a Bunsen flame. The remains of the section were washed in distilled water by flooding and drawing the liquid under the coverslip with filter paper. A solution of acidified iodine (1 part of 1% iodine in 5% potassium iodide: 1 part 5% sulphuric

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Accepted for publication
8 November 1989

Figure 1 Epithelioid granulomata with foreign body giant cell and calcific material (arrowheads). (Haematoxylin and eosin.)

acid) was then added to the washed remains of the section. A positive chitosan reaction is indicated by the spinous material immediately turning purple in colour. To serve as positive controls, chaetae removed from an aphroditid worm were treated in the same way.

Pathology

Macroscopically, there were extensive erosions and brown discolouration of the cartilaginous surfaces of the proximal interphalangeal joint. Histological examination showed an exuberant granulomatous inflam-

matory cell infiltrate in the dermis and subcutaneous tissues and in the proximal portion of the bone of the proximal phalanx. The infiltrate consisted of numerous epithelioid granulomata plus foreign body type giant cells, together with lymphocytes and plasma cells. Several of the giant cells contained crystalline calcific material (fig 1). Plentiful birefringent amber-coloured spines (fig 2) were present in the granulomatous infiltrate and some of these had pointed ends when seen in longitudinal section. Decalcified sections showed that the articular surface of the proximal phalanx was focally eroded by

Figure 2 Birefringent spines (S) seen in transverse and longitudinal section surrounded by granulomatous infiltrate containing giant cells. (Haematoxylin and eosin.)

Figure 3 Granulomatous infiltrate in bone of proximal phalanx. (Haematoxylin and eosin.)

fibrous tissue containing a similar granulomatous inflammatory infiltrate, which was also present in the medullary cavity between bony trabeculae (fig 3).

Electron microscopical examination showed that the circular spines were about 12 μm in diameter and solid. Others were elliptical,

egg-shaped, square with rounded corners or rhomboidal in shape. Little substructure was apparent.

Using a tightly focused beam of electrons, the spines were examined individually and collectively by *x*-ray microanalysis. This equipment detects elements above sodium in the periodic table, but no elements were detectable, suggesting an organic composition. By contrast, analysis of the crystalline inclusions found in some giant cells showed a small but important peak of calcium.

The spines in the finger section and the extracted annelid chaetae both showed an immediate purple colouration on addition of acidified iodine after potash treatment, indicating that both contained chitin.

Figure 4 Aphroditid annelid worm or "sea mouse". Note fine chaetae with protruding larger spines.

Discussion

Sarcoidal type tissue reactions to injury by sea-urchin spines have been well documented¹⁻⁴ and most cases exhibit a similar non-caseating granulomatous chronic inflammatory response. This reaction has also been described with date palm,¹ yucca, and rose thorn injuries.^{7,8} Destructive arthritis and loss of function necessitating amputation of the affected digit has been previously described but is rare.³

Our case conforms clinically and pathologically to those already documented, but detailed analysis of the spines found in the tissue blocks and sections in this case showed some interesting and unexpected findings.

Spines are found on many marine creatures, which may pose a potential hazard to bathers. It is only the relatively slow moving or sedentary animals, however, that seem to be a real problem. Injuries inflicted by sea-urchin spines are seen with increasing frequency now

that foreign travel is so popular. Sea-urchin injuries to bathers are well documented but the spines found in this case do not have any similarities with those found in this group of marine animals. Sea-urchin spines are formed from crystalline calcium carbonate (calcite) with an epithelial covering.⁹ In cross section they are highly ornate and symmetrical in form with a diameter of up to 2 mm.⁴ By comparison, the spines found in this case were much finer, lacked decoration, were amber in colour and lacked calcium. The von Wisseling test also indicated that they contained chitin. Chitin is found in both the arthropods and the annelid worms. As a considerable number of spines were found in the finger, the creature must have been covered in densely packed spines. To our knowledge no echinoderm or crustacean arthropod has such a densely packed arrangement of chitinous spines. The aphroditid annelid worms (*Phylum Annelida*, class Polychaeta, subclass Errantia, family Aphroditidae) or "sea mice", however, seem ideal candidates¹⁰ (fig 4).

Sea mice live on the sea floor, and have short and broad bodies up to 20 cm in length. These bulky worms are covered in fine hairs (chaetae). Around the periphery of the body, attached to segmental fleshy outgrowths (parapodia), are larger stiff sharp chaetae which protrude through the finer chaetae. All the chaetae contain chitin and are of a similar size and colour to those found in this case.¹¹ Importantly, these cosmopolitan, sediment

dwelling worms are less conspicuous than sea urchins. Thus injury by such chaetae would probably be ascribed to the more familiar spiny sea-urchin.

It is concluded that the spines found in the soft tissues of this case were probably the chaetae of an aphroditid worm or "sea mouse". This group of unfamiliar animals seem to be yet another hazard for the unwary Mediterranean bather. This, we believe, is the first such case to be reported in the English literature. It would be interesting to know how many injuries ascribed to sea-urchins are actually caused by "sea mice."

We thank Miss PL Rowland for skilled technical assistance.

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