THE NORTHERN HOSPITAL

CLAY SHOVELLER'S FRACTURE

"Unloading Coal", oil on canvas, Claude Monet, 1875.

"A characteristic list of fossils is used to recognize Ordovician rocks, Devonian rocks, and so on. So far all we are using these fossil assemblages for is to identify whether a slab of rock is say, Permian or Silurian. Now we move on to use the order in which the named strata were laid down, helped by daisychaining around the world, as evidence of which strata are older or younger than which. Having established these two sets of information, we can look at the fossils in successively younger strata, to see whether they constitute a sensible evolutionary sequence. Do they progress in a sensible direction? Do

*certain kinds of fossils, for example mammals, appear only **after** a given date? The answer to all such questions is yes. Always yes. No exceptions. That is powerful evidence for evolution, for it was never a **necessary** fact, never something that had to follow from our method of identifying strata and our method of obtaining a temporal sequence.*

*It is a fact that literally nothing you could remotely call a mammal has **ever** been found in Devonian rock or in any older stratum. They are not just statistically rarer in Devonian than later rocks. They literally **never** occur in rocks older than a certain date. But this did not have to be so. It could have been the case that, as we dug down lower and lower from the Devonian, through the Silurian, and then even older, through the Ordovician, we suddenly found that the Cambrian era - older than any of them - teemed with mammals. That is in fact **not** what we find, but the possibility demonstrates that you can't accuse the argument of being circular; at any moment somebody might dig up a mammal in Cambrian rocks, and the theory of evolution would be instantly blown apart if they did. Evolution in other words is a falsifiable, and therefore scientific, theory.*

Creationist attempts to explain such findings often achieve high comedy. Noah's flood we are told is the key to understanding the order in which we find fossils of the major animal groups, (i.e. invertebrates to fish to amphibia to reptiles to mammals to Homo Sapiens). Here's a direct quotation from a prizewinning creationist website:

...This sequence is a perfectly satisfactory explanation of the order in which the various fossils are found in the strata. It is NOT the order in which they evolved but the order in which they were inundated at the time of the flood...

*Quite apart from all the other reasons to object to this remarkable explanation, there could only ever be a **statistical** tendency for mammals, for example, to be **on average** better at escaping the rising waters than reptiles. Instead, as we should expect on the evolution theory, there are literally **no** mammals in the lower strata of the geological record. The "head for the hills" theory would be on more solid ground if there were a statistical tailing off of mammals as you move down through the rocks. There are literally **no** trilobites above Permian strata, literally **no** dinosaurs (except birds) above Cretaceous strata. Once again, the "head for the hills" theory would predict a statistical tailing off"*

Richard Dawkins, "The Greatest Show on Earth", 2009

At the top of one of the many grand marble staircases of the great Palladian mansion that is Burlington House on Piccadilly, home of the London Geological Society, in addition to many other learned societies, hangs one of the most remarkable historical documents anywhere in the world. Yet it remains largely unknown, even to those who constantly ascend and descend the great staircase. It is an old, but very beautiful 8.5 foot by 6 foot hand coloured map that remains hidden from the damaging effects of ultraviolet light, behind two great velvet curtains. It was produced in 1815 by a remarkable man of humble birth, William Smith - a child of the Industrial Revolution.

While working as surveyor in a coal mine in 1769 he noticed abrupt changes in the nature of the layers of rock as he was lowered into the depths of the Earth, but more

interestingly he noticed that each of the layers, or strata as he referred to them, always appeared in exactly the same order, no matter where they were found. Even more remarkably he noticed that the same specific fossils within these strata invariably occurred within the same strata. He postulated that the deeper strata were the oldest formed, whilst the top strata were the most recently formed. Although he had no way of knowing the exact age of the various strata he was able to determine that they always occurred in the same order, no matter where he was within the British Isles and so he knew their relative ages with respect to each other. He came to understand that by identifying specific fossils he could determine exactly which strata he was in. The black gold of the Industrial Revolution - coal - for example, was contained within Carboniferous strata - and these strata could be identified by the specific Carboniferous fossils contained within it. This was priceless information to the industrialists who wanted to find coal seams. This type of knowledge would later allow others in the Twentieth Century to make fortunes in oil, gold, silver, and rare Earth precious metals. Today geologists use microfossils to very specifically identify the age of strata they are looking at. Great scientific advances came in the Twentieth century in the form of radiometric dating techniques which ultimately gave precise dating for each of Smith's strata.

Smith first developed his theories in the field of practical geology - under the Earth - but they were initially rejected and in fact ridiculed by the aristocratic professional arm-chair "geologists" of the London Geological Society of the day - who had never set foot in the abyss of a damp, suffocating and dangerous coal mine. Before the great age of rail, the industrialists had to find a way of transporting immense quantities of coal to the great industrial centres of Britain, - Manchester, Birmingham and London. Before rail this would be by water canals. Intricate networks of hundreds of miles of canals were dug from rivers and lakes which allowed for the smooth transport to the cities of great barges bearing coal that would power the Industrial Revolution and the world Empire that Britain would reign over in the time of Queen Victoria and King Edward VII. Smith would be employed in the surveying and digging of many of these canals and the more he surveyed and dug and mined - across the width and breadth of Britain - the more he was able to confirm his theories on geological strata and the fossils they contained.

Smith's theories gleaned from long years of back-breaking work in the coal mines and canal channels would not earn him instant recognition - quite the contrary. He endured many years of rejection and ridicule which would lead to depression and homelessness for almost ten years. His marriage would break down and he would spend time in a grim debtor's prison, even having to sell his priceless fossil collection acquired over many years. Towards the end of his life however a younger more enlightened generation of geologists began to accept his work and recognize him for the genius that he was. They saw that even some older die hard geologists whilst on the one hand rejecting his theories were on the other plagiarizing his work as their own! Enough was enough! In February 1831 the Geological Society of London awarded Smith the first Wollaston Medallion, its highest honor in recognition of his lifelong work. King William IV granted him a pension that allowed him to avoid the debtor's prison for the rest of his life.

The true value of William Smith's work does not lie in the fortunes that were made by the Captains of Industry of the Nineteenth and Twentieth centuries. Its true value very much

transcends this base notion. His map today is recognized as the very first geological map, painstakingly put together over twenty years of observation in the field. It not only laid the foundation for the coal powered Industrial Revolution, but more importantly played a crucial role, along with the ideas and works of James Hutton, Charles Lyell and Thomas Malthus in helping Charles Darwin formulate his theory of evolution and hence increase humanity's understanding of where it has come from, its place in the universe, and indeed of all life on Earth.

The great captains of industry who drove the Industrial Revolution are well known to history, but those who are not of course known are the hundreds of thousands of manual workers, the miners and the barge workers and the coal loaders, on whose back-breaking work the prosperity of the rest of society depended. No recognition for them, no benefits for them, history does not even record their names. Most would lead a life that can only be described by the classic words of Thomas Hobbes in "Leviathan": "No arts; no letters; no society; and which is worst of all, continual fear, and danger of violent death: and the life of man, solitary, poor, nasty, brutish and short." We see some of them in the anonymous figures of the haunting image of Monet's, "Unloading Coal", of 1876. Injury and death were common among these workers. Injury meant no work and in an age without any form of social security, a lack of work for those who had only their labor to sell would mean starvation for themselves and their families. A simple injury to which many of these workers were prone was the "clay-shovellers fracture" - a mild injury today - but for a Nineteenth century coal miner - a possible matter of life or death!

CLAY SHOVELLER'S FRACTURE

Introduction

The term "clay shoveller's fracture" is a traditional term applied to traction factures of the spinous processes of the lower cervical or upper thoracic vertebrae. [1]

This injury was first recognized in 1933 among manual workers who were shovelling clay in Western Australia.

Management of this uncommon injury is usually conservative.

Mechanism

This injury was originally described in manual workers who shovelled clay. When their shovel struck a solid impediment the force of the upward swing would be transmitted to the trapezius muscles, which could on occasion cause a traction/ avulsion fracture on the spinous process attachment of the trapezius.

Fractures by this mechanism are most commonly of the spinous process of the seventh cervical vertebra, but can range from the spinous processes of C6-T3 [1]

Single fractures are most commonly seen however multiple fractures can occur due to the transmitted pull of the inter-spinous and supra-spinous ligaments.

A similar fracture can also be seen by direct impact trauma to the back of the neck

Complications

These fractures are considered stable when produced by the classical "clay shoveller's" mechanism", unless the fracture is not limited to spinous process but extends into the lamina; where there is greater potential for spinal cord injury.

Fractures produced by a direct impact blow are more problematic, and have greater potential for associated spinal cord injury.

Clinical assessment

Important points of History:

The history of the mechanism is important.

- The injury is usually stable when produced by the classical "clay shoveller" mechanism
- Injury produced by direct impact trauma has greater potential for associated spinal cord injury.

There is immediate pain experienced in the mid line of the lower neck to the region between the scapulae.

A “cracking” sensation may be experienced.

Important points of Examination:

- Pain is exacerbated by virtually any movement of the shoulders, or any action involving the trapezius or rhomboid muscles.
- Flexion or extension of the head will produce pain.
- There is point tenderness over the site of the fractured spinous process.
- Crepitus may be felt in more severe cases.

Investigations

Plain radiography

A lateral radiograph will make the diagnosis in most cases.

“Clay Shoveller’s Fracture”, involving the spinous processes of C6 and C7

Note that because there is no history of direct trauma clay shovelers fractures are often missed because radiographs are not taken in the first instance (and a diagnosis of "muscle strain" is made).

If symptoms are significant enough and the mechanism is there, then radiographs should be taken specifically to look for this injury.

In cases of direct trauma radiographs should of course always be taken when symptoms and/or energy of impact are significant.

CT Scan

This may make the diagnosis in more subtle cases or when plain radiographs are equivocal.

For fractures near the lamina, CT scan is advisable to assess whether there has been extension into the lamina.

MRI

This is best able to assess associated ligamentous injury.

It should be done if there is any suspicion of associated neurological injury, although this would be very unlikely when the injury is induced by the usual "clay shovelling" mechanism.

Management

Give analgesia as clinically indicated

The majority of these injures are stable and uncomplicated and can be managed conservatively.

A hard collar can be worn for 2-3 weeks. [2]

"A delineation of the Strata of England and Wales and part of Scotland; exhibiting the collieries and mines, the marshes and fen lands originally overflowed by the sea, and the Varieties of Soil according to the variations in the substrata, illustrated by the most Descriptive Names by William Smith"

Published by William Smith, 1815, Geological Society of London.

References

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2. McRae R. "Practical Fracture Management", Churchill Livingstone, 2nd ed 1989, p. 192.

Further reading:

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Simon Winchester, "The Map that Changed the World", Penguin Viking 2001

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