FROM THE ORTHOPAEDIC CLINIC, LUND. HEAD: PROFESSOR GUNNAR WIBERG

ELECTROLYTIC INFLAMMATION FOLLOWING OSTEOSYNTHESIS BY THE METHOD OF McLAUGHLIN

By

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It is known that the use of different metals for the internal fixation of fractures, for example, can set up a considerable difference in electrode potential with consequent risk of corrosion at the site of the operation and subsequent electrolytic inflammation.

In a recent analysis of the underlying mechanism of this phenomenon *Bowden Williamson* and *Laing* (1955) showed that the use of a single metal for such internal appliances does not eliminate the risk of corrosion either. They produced unequivocal evidence that small particles of metal can be transferred from the orthopaedic tool to the appliance and further that the mass of metal transferred varied with the amount of play or slip between the tool and the appliance (driver and screw or spanner and bolt). These apparently trivial fragments may cause a continous flow of metal ions into the surrounding tissue.

This risk of transfer of metal from the tool to the appliance is particularly great when a pilot hole is drilled into bone through a plate hole and the plate is made of metal harder than the drill. This situation is common in the internal fixation of pertrochanteric fractures with a nail and plate by the method of McLaughlin, especially as 5 pilot holes are drilled at every operation.

As in this operation the plate is made of vitallium and the drill of high speed steel, if any contact occurs between the two metals during the drilling procedure, metal fragments will be transferred from the softer metal to the harder (*Bowden Williams* and *Laing*), i.e. from the drill to the plate. These authors produced convincing experimental

evidence that the mass of metal transferred in this way is sufficient to produce electrolytic inflammation.

From June 1954 until June 1956 forty-seven patients with pertrochanteric fracture were treated by internal fixation by the method of McLaughlin. Long after the fracture had healed 6 of them returned because of fistula or abscess at the site of the operation. The interval between the operation and the complication ranged between 2 months and 14 months. None of these 6 cases showed the picture of septic inflammation and in none did culture of the discharge give rise to growth. In the last 2 cases a biopsy specimen of the granulation tissue close to the plate was removed. Microscopic examination revealed that the granulation tissue contained particles of iron. In all of these 6 cases removal of the plate was followed by prompt recovery.

By the time of operation of the last 2 cases we were better acquainted with this type of complication. These cases were therefore investigated more thoroughly and are described in brief below.

Case 5. (657/56). On November 8, 1955, left pertrochanteric fracture was treated by internal fixation by the method of McLaughlin.

Six weeks later the patient could walk with the aid of trestles and was sent home.

Follow-up examination on January 24, 1956, revealed a small abscess in the upper end of the scar.

One month later a fistula was seen with hyperthophic granulation tissue and a continuous purulent discharge. The patient now complained of pain and tenderness. Culture of the discharge gave no growth.

After a further month the plate was removed. The actual fistula was cut out for microscopic examination. Grey-green pus-like fluid flowed out of the stump of the fistula. This discharge was collected and cultured for growth. The muscle was then divided down to the head of the nail. Abundant granulation tissue was seen round the plate and the head of the nail. Biopsy specimens were removed from the granulation tissue and from the surrounding connective tissue. The screws and the nail were then removed without difficulty.

The wound was closed and healed by first intention.

Microscopic examination.—The fistula was lined with regular squamos epithelium. The connective tissue near the edge of the fistula showed areas with a certain degree of fibrosis and contained giant cells of foreign body type. A fair number of resorption cells were seen in the surrounding tissue. The separate specimen of granulation tissue showed essentially the same picture. Here, however, the tissue was more edematous and contained pus cells in almost abscess-like formations. The specimen also contained cells of foreign body type and the tissue was richly vascularised. No signs of malignancy were observed.

Diagnosis: non-specific inflammation with foreign body reaction.

When last seen on May 16, 1956, the wound had healed and the patient could walk without support.

Case 6. (705/56).—On January 28, 1955, pertrochanteric fracture was treated by the method of McLaughlin. The postoperative course was uneventful. By the time of follow-up examination on April 7, 1956, the fracture had healed and the patient could walk without support.

One month later, however, he complained of pain and swelling in the region of the operation. Examination revealed an abscess the size of a hen's egg at the operation site.

The following day the wound was opened and the nail and plate removed. The picture resembled that in the previous case with still more abundant granulation tissue. A biopsy specimen was excised and the discharge was collected for culture.

Culture of the discharge gave no growth.

When last seen on May 17 the wound had healed.

Microscopic examination.—Both biopsy specimens showed essentially the same picture. They consisted of fairly fibrotic tissue with a number of vessels but were built up mainly of young well vascularised granulation tissue containing abundant inflammatory cells in some regions as well as round cells and sometimes also many leukocytes. Blood pigment was noted in some areas. Giant cells of foreign body type and the presence of iron particles were observed.

Diagnosis: non specific purulent reaction with inflammation with foreign body reaction.

COMMENTS

In all of the six cases the early postoperative course was smooth. Not until at the earliest 2 months after the operation by which time the fracture had healed did complications occur and then they were always of the same type and culture never gave growth. Removal of the plate was regularly followed by prompt recovery. Therefore much suggests that the complication was due to electrolytic inflammation.

One might imagine that the use of a hand drill instead of an electric drill for drilling pilot holes into the bone through the plate holes would eliminate the risk of this complication. But such a procedure would be extremely tedious. In an attempt to minimize the risk of electrolytic inflammation without undue prolongation of the operation we intend to continue to use an electric drill but to use a hand tool for drilling the pilot holes through the exterior cortex. The results obtained will be the subject of a later paper.

The presence of two different metals can be avoided by the employment of tools made of vitallium. Unfortunately, however, vitallium drills have hitherto been unavailable, but now such drills have been advertised in J. B. Jt. Surg.

SUMMARY

Og 47 cases of pertrochanteric fracture treated by internal fixation by the method of McLaughlin fistulae or abscesses occurred later (2–14 months after operation) in 6. Culture of the discharge never gave growth.

Removal of the plates and nails was regularly followed by prompt recovery.

The complications were thus probably due to electrolytic inflammation.

In an attempt to minimize the transfer of metal from the tool to the plate without undue prolongation of the operation it is intended to continue using an electric drill, but to drill the pilot holes through the cortex with a hand tool.

RESUME

Sur 47 cas de fracture pertrochantérienne traités par fixation interne au moyen de la méthode de McLaughlin, des fistules ou des abcès se sont produits plus tard (de 2 à 14 mois après l'opération) dans 6 cas. A la culture, les prélèvements n'ont jamais donné de croissance.

L'enlèvement des plaques a été régulièrement suivi d'une prompte guérison.

Les complications ont donc vraisemblablement été dues à une inflammation électrolytique.

Afin de minimiser le transfert de métal de l'outil à la plaque, sans prolonger indument l'opération, il convient de continuer à employer le foret électrique, mais d'avoir recours à un outil à main pour percer les trous pilote à travers le cortex.

ZUSAMMENFASSUNG

Bei einer Anzahl von 47 Fällen von pertrochantärer Fraktur, die mittels interner Fixation nach McLaughlins Methode behandelt wurden, trat später in 6 Fällen (2–14 Monate nach der Operation) Fistel- oder Abscessbildung auf. Die Kultur des Eiters war immer negativ.

Entfernung der Platten führte immer zu rascher Heilung.

Man ist daher geneigt anzunehmen, dass die Ursache dieser Komplikation ein elektrolytischer Reizzustand ist.

Es wird deshalb der Versuch gemacht werden die Überführung von Metall vom Werkzeug zur Platte möglichst herabzusetzen ohne die

Operationsdauer unnötig zu verlängern indem man zwar den elektrischen Bohrer weiterhin verwendet, jedoch die Führungslöcher durch die Corticalis mit einem Handinstrument ausführt.

REFERENCES

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