

## Fractures and Nonunions of the Carpal Navicular

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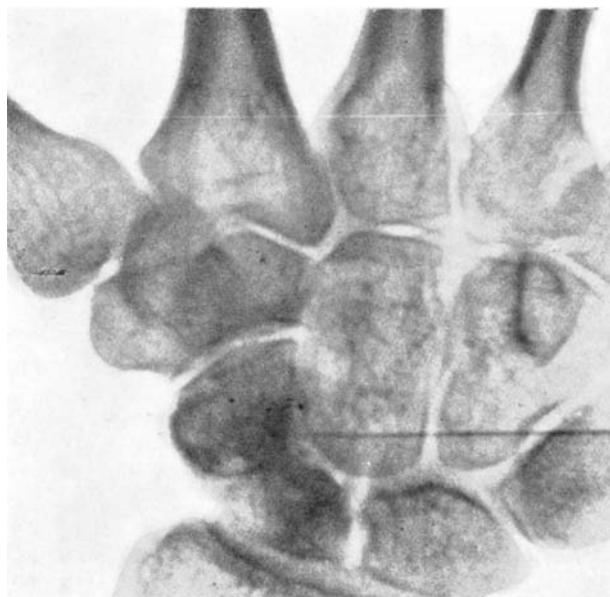
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After my fellow speaker Dr. Sierra Cano's brilliant presentation there is not much more for me to say. He discussed the topic in a clear, comprehensive and extremely didactic way, touching on each one of the problems posed by the diagnosis and treatment of carpal scaphoid fractures, especially in the realm of occupational trauma.

Together we have been studying the specificities of this injury for quite a number of years and back in 1933 we already published a joint study of 25 cases<sup>9</sup>. Subsequently, in 1951, we published another paper where we studied an additional 40 cases<sup>6</sup>. In this new contribution, we would like to present our experience of 106 further cases, which brings the total number of cases studied to 171, a figure that appears modest if compared to other series, but which is high enough for us to make a few considerations and establish our own rules of procedure.

As Dr. Sierra said, diagnosing a scaphoid fracture is not always easy. Sometimes it is the symptoms rather than x-rays that allow us to obtain a diagnosis since, in spite of radiographing the bone in four positions (following Böhler<sup>3</sup> et al), the anatomy and physiology of the bone are such that it is not always possible to detect the fracture at the early stages. We do however retake the x-rays 2 and 4 weeks later, during which we keep the patient partially immobilized waiting for bone resorption to take place and for the fracture line to become visible. For some time now, we have used, in case of doubt, enlarged radiographs, according to the technique described by our Head of Radiology, Dr. Gutiérrez del Olmo<sup>4</sup> (fig. 18). Using a standard x-ray tube, these enlarged radiographs permit visualization of certain details of the bone surface that are not apparent in standard films. Thus, fracture lines can now be seen that would have otherwise gone undetected, with their healing process now liable to accurate monitoring.

As regards diagnosis, we believe that instances of delayed healing should be distinguished from genuine pseudoarthroses, which is important from the therapeutic and the statistical point of view, since many successes attributed to a certain procedure are not really successes at all since the fractures were treated incorrectly and, if properly immobilized, would have healed appropriately without the need of surgery. In order to diagnose nonunion, the x-ray features of nonunion must be fully and unambiguously visible.



*Fig. 18. Enlarged radiograph of a carpal nonunion.*

When studying the mechanisms of injury, it is important to bear in mind the «clapper-like movement» made by the scaphoid in the course of carpal motion, which makes the bone highly vulnerable in certain positions.

Since we published our first paper, we have noticed a diagnostic sign which is usually present, especially in distal scaphoid fractures: on tensioning the abductor muscles of the hand, the patient feels pain and abducts the thumb. This sharp pain at the level of the snuffbox can easily be understood since the short abductor attaches proximally to the scaphoid. We have not seen this sign mentioned in the literature.

It would be idle to insist on what Dr. Sierra already discussed so brilliantly. I will instead focus on the treatment of the condition, which is one of the aspects on which there is greatest controversy. We believe that cast immobilization that is correctly applied for long enough for full healing to take place is without doubt the procedure of choice. Surgical approaches to the scaphoid are demanding procedures that yield variable results; for us, they should be avoided in recent fractures (taken broadly). Indeed, we have seen three-month-old fractures that healed by simple immobiliza-

tion. This means that we reject the criterion by Soto-Hall and Halderman<sup>10</sup>, who claim that even in fractures that are just one month old no time should be wasted and surgical fixation should be undertaken at once with bone grafting.

Now, what should we do when confronted with a fracture that has been immobilized for a long time and still will not heal? First of all, we must make sure immobilization was correctly applied and, if necessary, intone a *mea culpa* and perform a new immobilization. Please forgive our insistence, but the fact is that poor immobilizations unfortunately tend to be fairly common. If immobilization was appropriate we believe that, before a surgical procedure is attempted, the healing process should be activated by means of stellate ganglion infiltrations or by cautiously performed Beck-type perforations; these are simple procedures that *can* in some cases be successful, although some authors reject them on the grounds that they deteriorate the fractured fragments.

Once pseudoarthrosis has set in, the only option available is surgery. With many other authors, we reject mutilating procedures. In cases in which we excised part (or the whole) of the scaphoid, a significant carpal imbalance appeared. And the patients subjected to a follow-up showed either fully-fledged or budding osteoarthritis after some years. This type of surgery is simple and tends to afford spectacular immediate results; these results nevertheless do not normally persist. Some authors excised not only the proximal portion but also the semilunate, ut they have long discarded this procedure given the degree of stiffness it provoked.

We are then left with an osteosynthesis with the use of bone grafting which, for us, is the best both theoretical and practical alternative (we lack experience of a procedure used with good results by Dr. Troncoso consisting in the refreshment of fragments and their fixation by means of an *ad hoc* screw). We have carried out our osteosyntheses with a single graft, in line with the technique described by Watson-Jones<sup>12</sup> (fig. 19) and Bernard and Stibbius<sup>1</sup> (fig. 20). Given our strict criteria, we have as yet operated only seven cases in five of which we have obtained a successful result.

For us the procedure proposed by Bernard and Stibbius<sup>1</sup> has the advantage that removing the radial styloid avoids direct contact between the radius and the proximal scaphoid, often deeply embedded in the radial joint surface, which in our view may be one of the causes of the healing difficulties (fig. 21). In addition, viewing and approaching the scaphoid is easier, and the surgical approach more correct, with the removal of the radial styloid, which can often be used as graft material. We wish to underscore that this is a demanding technique that should only be performed by experienced surgeons. With Soto-Hall and Halderman<sup>10</sup> and Merle D'Aubigné<sup>7</sup>, we also believe that necrosis of the fragments does not contraindicate the grafting procedure required by the necrosing fragment (fig. 22).

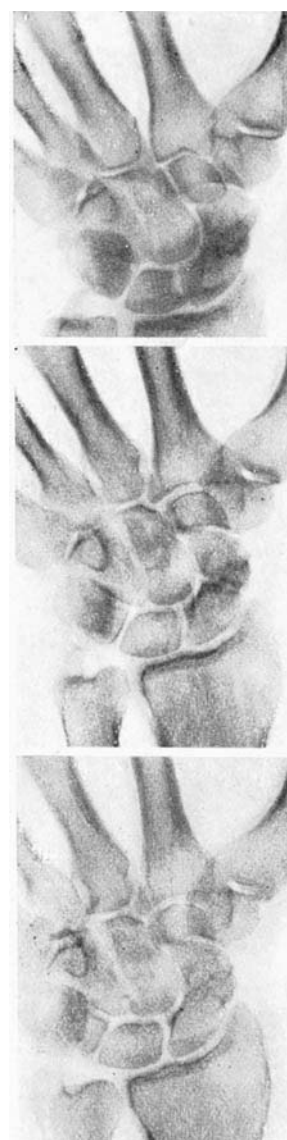
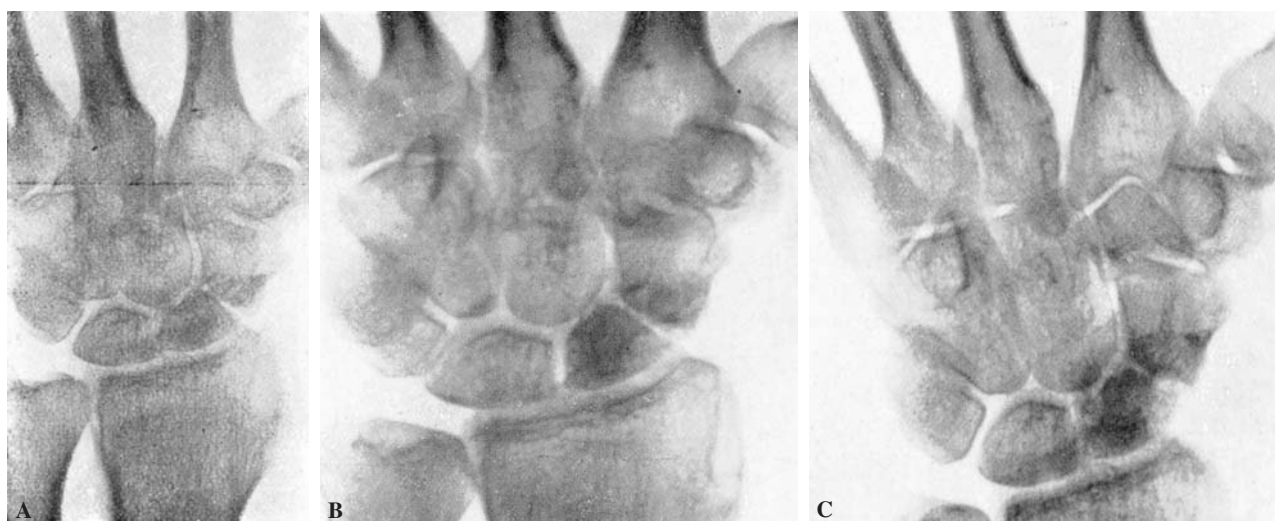


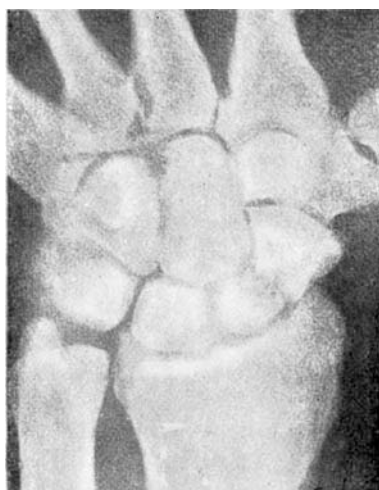
Fig. 19. X-ray of a case of nonunion managed by means of the Watson-Jones' technique. Pre-operative situation and views at 3 and 5 months post-op.

We have found no advantage whatsoever in the use of multiple grafts since this would complicate the surgical technique. With Soto-Hall and Halderman<sup>10</sup>, we prefer to act upon small bone fragments, which tend to break up easily.

We have no experience of the total or partial ablation of the scaphoid and its replacement by a vitallium or acrylic component. We think that this might be a step in the right direction since such a component could prevent carpal imbalances. Nevertheless, we see no advantages to the approach advocated by Sierra Cano consisting in a partial replacement of the bone, i.e. replacing only the necrosed fragment, since it is easier to get a series of resin-made scaphoid bones than having to adapt the natural bone to



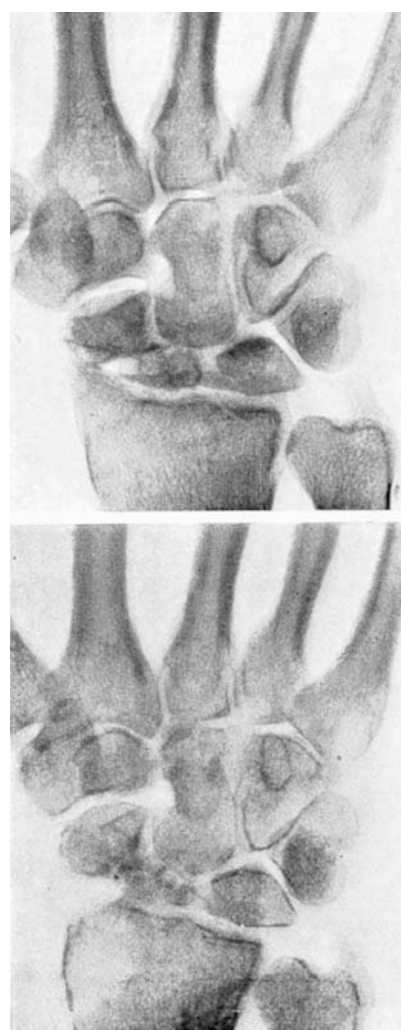
*Fig. 20. Standard and enlarged radiographs of a case of nonunion operated according to the Bernard and Stibbius technique.*



*Fig. 21. The proximal fragment is embedded in the joint surface of the radius. The radial styloid is likely to exert a detrimental mechanical action.*

the partial loss present in each case. Not to mention that the neoarthrosis that occurs between the prosthesis and the unexcised fragment could lead to carpal alterations. In cases in which there is a persistence of carpal pain incompatible with a workman's occupational requirements, the only alternative is recourse to wrist arthrodesis since procedures such as wrist denervation must be ruled out.

Having made these considerations, we can now focus on the treatment and the outcome of our own cases, according to our statistics. We shall only refer to the last 106 cases treated (fig. 23); 87 are recent and 19 old (we consider recent cases those that came to our Department within four weeks of trauma; the majority (84) were seen in the first three days).



*Fig. 22. Nonunion operated with bone grafting; the second x-ray shows the fragmentary bone regeneration at three months post-op.*



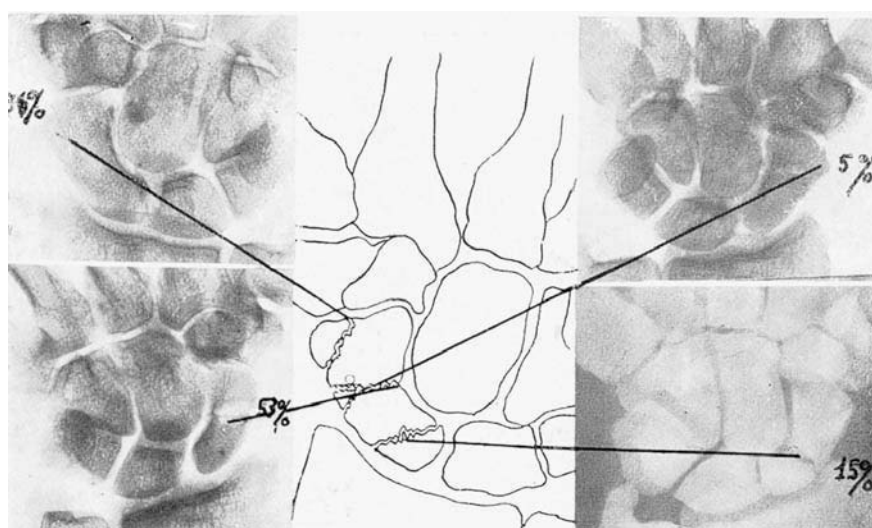


Fig. 23. Location of the fracture in the cases studied.

Cast immobilization was used in all cases (with reduction maneuvers when necessary), with the hand in slight dorsal flexion, the radius inclined and the thumb in intermediate abduction-opposition, with the cast always including the first phalanx of thumb and reaching up to the upper third of the forearm. We never immobilize the elbow. We do not use any kind of pads and the plaster cast must obviously be well adapted to the bone contour. We find no advantage in ending the thumb's immobilization at the fifth week, as Soto Hall and Halderman<sup>10</sup> do, since this disrupts the correct immobilization process.

The condition of the plaster casts should be checked regularly and replaced if necessary, especially taking into account that casts covering the hand tend to become badly deteriorated. If plaster casts are not kept in good condition, immobilization will never be achieved.

Duration of the immobilization period tends to vary; it is virtually impossible to provide hard-and-fast rules. Only the examination of x-rays taken after a reasonable period can give us a clear indication the healing has occurred.

In 13 cases the cast was applied for up to 7 weeks; in 39 cases the cast was applied between 7 and 14 weeks; in 18 cases the cast was applied between 14 and 22 weeks; in 12 cases the cast was applied between 22 and 44 weeks.

The total number of patients was 82. In all cases radiographic healing was achieved.

One case was a bilateral fracture, a rather infrequent occurrence, which healed uneventfully<sup>6</sup>. In 72 cases, supplementary physical therapy had to be used, as well as gymnastics, short wave irradiation and Bier chamber treatment. All 82 cases healed with no sequelae. In 5 cases, after 44 weeks' immobilization, the plaster cast was removed; in one, two x-rays revealed the presence of nonunion with

necrosis of the proximal fragment considered to be secondary to surgery; in another three, there was no hint of nonunion but rather a remarkably delayed healing, which led to the carrying out of Beck perforations and to the maintenance of the plaster cast for 8 more weeks. Healing was achieved in all three of them but one developed carpal stiffness and an onset of osteoarthritis (the patient was 65 years old).

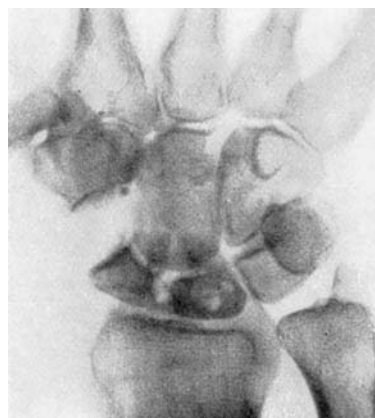
The two pseudoarthroses were approached by means of fixation plus bone grafting, in one case the Watson-Jones<sup>12</sup> technique was used, and in the other, the Bernard and Stibbius<sup>1</sup> technique; the first case healed but in the second the necrosis of the proximal fragment worsened to the extent that a decision was made to excise the bone, which led to a carpal imbalance and an associated disability.

This means that out of the 87 cases seen most recently, those successfully treated with a plaster cast, in which healing was achieved and no sequelae were observed, amounted to 82. Of the 5 remaining patients, three healed without sequelae with the treatment applied but two did develop some degree of disability. Therefore, the failure rate for the group was 2,52%, with two cases of pseudoarthrosis, which confirms what we said about plaster cast treatment.

The 19 cases seen once nonunion had established itself were distributed as follows: three were not treated owing to the patients' age and general health status (fig. 24); six were subjected to surgical fixation with bone grafting, according to the Bernard and Stibbius technique<sup>1</sup>; and one was operated with the Watson-Jones procedure<sup>12</sup>; in seven, plaster cast immobilization was used, supplemented by stellate ganglion infiltrations; in one case a Beck perforation was performed; two cases were subjected to an excision of the necrosed distal fragment.



*Fig. 24. Inveterate nonunion with perfect tolerance.*



*Fig. 25. Excision of the distal fragment, late necrosis of the proximal fragment and the lunate bone.*

The results were: of the 6 patients subjected to osteosynthesis, 5 healed uneventfully; in one, the graft got resorbed, which led to a painless non-union. Of the seven patients that were immobilized with a supplementary stellate ganglion infiltration, four healed, i.e. the nonunion was only apparent or either the weight-bearing or a correct stimulation brought about the healing of the fracture. As regards the remaining three cases, the pseudoarthroses remained: two with carpal pain and limited motion and one that is painless and exempt from stiffness. Two patients had the distal fragment excised: one was left with carpal stiffness and pain (fig. 25) and the other showed certain stiffness but resumed his work without disability.

## SUMMARY

Nineteen patients were seen when nonunion was already established. In nine, healing was achieved without sequelae. In three, the nonunion persisted with disability. In one case, the non-union persisted, but without sequelae. One of these cases healed, but the sequelae were still present. There were two partial excisions, one without sequelae and the other with some disability. Three patients were not treated. Total: six cases had disability, ten were healed and three were untreated. Out of a total of 8 patients treated with bone fixation, 6 achieved healing without sequelae.

## REFERENCES

1. Bernard L, Stibbius S. Styloidectomy of the radius in the surgical treatment of non-union of the carpal navicular. *J Bone Joint Surg.* 1948. p. 98.
2. Boerema I. Über die pseudoarthrose dees os naviculare manus. *Arch Orthop. Unfall Chir.* 1938;38:42.
3. Böhler L, Trojan E, Jahna H. Behandlungsergebnisse von 734 frischen einfachen Brüchen des Kahnabakörpers der Hand. *Wiener Ztschr Chirg Traumat.*, 2, 86 bis, 111. S. Karger Basel. New York 1954.
4. Gutiérrez del Olmo J. Radiografía aumentada. *Medic Segur Trab.* 1953. p. 34-8.
5. Morisi M. Considerazioni sul trattamento delle fracture e delle pseudoartrosi dello scafoide del carpo. *Chir Org Mov.* 1953;39:386.
6. López de la Garma F, Fernández Ladreda M. Fracturas del escafoide carpiano. *Cir Ap Locom.* 1951;8:243.
7. Merle d'Aubigné: Affections traumatiques (Mise a jour, 1954), páginas 673-8.
8. Nepi A. Frattura bilaterale simultanea dello scafoide carpale da iperflezione. *Ortop Traum Ap Motores*, 385, 1950.
9. Sánchez Bordoná JM, López de la Garma F. Consideraciones sobre 25 casos de fractura del escafoide carpiano. *Los Prog Clin.* 1933. p. 109-17.
10. Soto Hall R, Halderman KC. The conservative and operative treatment of fracture of the carpal scaphoid. *Journ Bone Joint Surg.* 1941. p. 841.
11. Vernes M. Diagnóstico clínico y radiográfico de las fracturas recientes del escafoide carpiano. *Pres Méd.* 1954;62:1468.
12. Watson-Jones R. Fracturas y traumatismos articulares. *Salvat.* 1945. p. 580-2.