Technical note

A screw for cervical hip fractures designed to minimize migration

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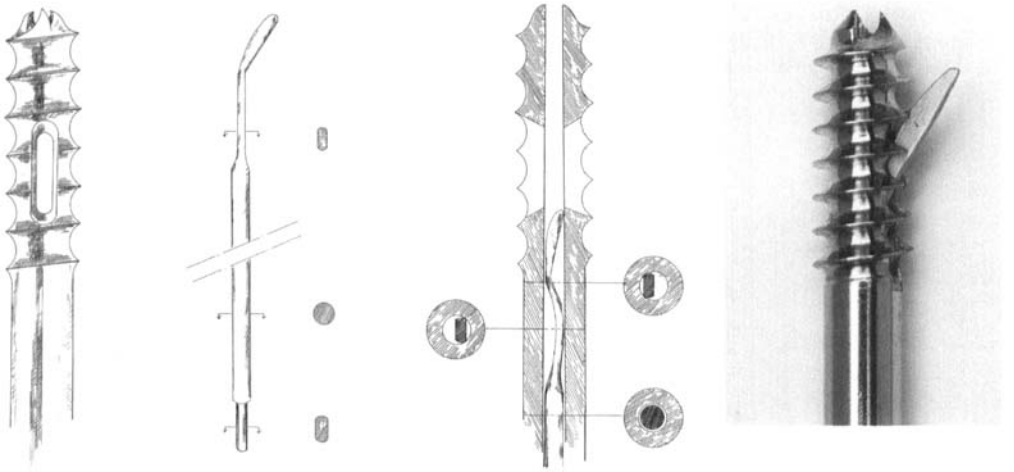
In Acta Orthopaedica Scandinavica 1995; 66: 249–251, Per Adolphson reports on 7 cases of intrapelvic penetration of the Uppsala Hip Screw used for transcervical hip fractures (Adolphson 1995). Luckily the complication is rare. According to Adolphson's data, the 95% confidence interval for the incidence is 0.1—0.9%. In our own experience of now over 1600 consecutive patients treated with the device we have not seen one case of intrapelvic penetration representing an incidence of up to 0.2% (Wilson Quadratic Method in Dorey et al. 1993), although in a few patients we have seen penetration into the hip joint (Rehnberg and Olerud 1989a,b, Olerud et al. 1991). However, since intrapelvic penetration is a severe complication—Sundgren and Persson (1994) reported a fatal outcome in 1 of their 4 cases—we are trying to redesign the screw to avoid a recurrence of this problem.

The painful complication with protruding screw ends in the thigh caused by screws which have "backed out" from the fracture area will also be seen more seldom.

As Adolphson correctly points out, the mechanism of the medial migration of the screw is unknown. However, a reasonable hypothesis is that instability and micromotion at the fracture site may create a torsion moment on the screw which propagates upwards and inwards into the pelvic cavity. The fact that the hip implants are threaded, as in the publications of Molander (1978) and Kohlstad (1986), cannot be the

Figure 1. The threaded part of the screw.



A. The opening into the central hole of the screw.

B. The central pin with the three portions: the leveled point, the central cylindric form and the square -formed end.

C. The leveled portion of the central pin before the barb emerges from the opening. The elasticity of the pin permits different positions of the pin at different levels of the screw canal.

D. The curved barb becomes even more bent when it touches the upper border of the thread opening.

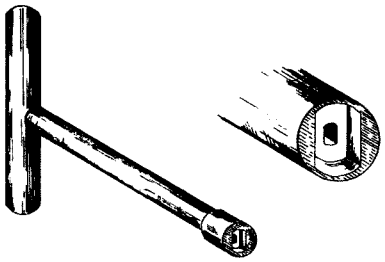


Figure 2. **The introduction tool.** The enlargement shows the outer purchase for the screw end and the inner squared purchase for the central pin.

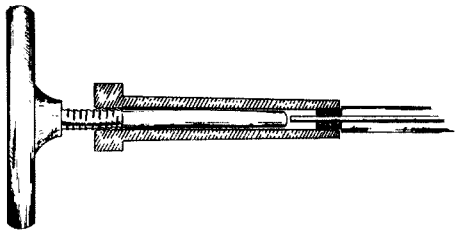


Figure 3. **The pusher adapter** is threaded to the screw end before turning the handle to put the central pin into its definite position.

only reason. Pelvic penetration has also occurred with the non-threaded LIH pin (Benoni et al. 1995).

We have considered two ways to prevent this medial migration. The first is to fit a washer or hat to the end of the screw, which would prevent the distal end from penetrating the lateral cortex of the femur. However, medial penetration would still be possible in the not infrequent event of resorption of the femoral neck at the fracture site. Moreover, adding bulk to the distal end of the screws may increase the incidence of pain and tenderness over the screw ends. Instead, we have fitted the Uppsala Hip Screw with a barb that prevents rotation in the femoral head (Figure). A similar design was used in 1964 (Rydell 1964) to prevent a smooth hip implant from sliding out and it is also used in the hook pin devised by Hansson (1982).

The new design combines the threaded part of the screw with a torsion-locking barb emerging from a central pin in the implant. The details about the screw are presented in Figure 1. Close to the top of the screw there are two openings, just opposite to each other. This means that there will be two ways to turn the barb from the central hole in the screw.

The central pin consists of three parts (Figure 1 B). The mid-portion has a diameter slightly less than the canal diameter in the screw. The upper portion is leveled and has a flexed form. Its width is even smaller than the diameter of the screw hole. It is easy for the angle-formed top of the pin to pass through the central canal of the screw without deformation. The reason for this is elasticity in the thinner part of the pin below the angulation. The pin will regain its form as soon as the point meets the opening in the screw. When the pin moves forward the point is further bent out as it hits the upper edge of the screw hole. The lower portion is square-shaped at the end to fit the tool, which will introduce the pin into the central hole of the screw (Figure 2).

The introduction tool (Figure 2) also has another inside grip, which will fit the outer key grip of the screw. When the outer of these two purchases fits the end of the screw, the flexure of the pin will always point to one of the openings in the threaded part of the screw.

When introducing the pin into the screw, the curved part of the pin is inserted manually (because percutaneous assembly with an adapter is necessary), the pin end must fit the square hole in the introduction tool. The pin is then pressed through the whole length of the screw until the end of the introduction tool touches the screw. In this location the pin point will be very close to the openings in the threaded area of the screw. For further advancement, the introduction tool has to be turned until its key form squares with the end form of the screw, whereupon the curved point will fall out in one of the openings.

As a last procedure, an adapter (Figure 3) with press equipment is fastened to an outside thread at the end of the screw. A pusher threaded to the adapter will then press the pin point further out of the threaded area of the screw. The pin point touches the upper limit of the opening and will be further bent. Finally, it will squeeze its wedge form to the sides of the opening, whereupon the pin is locked in place.

If the pin has to be removed for some reason, the pin end has a thread, to which an extractor can be connected.

Acknowledgement

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