Extradural and subarachnoid catheterization using the Seldinger technique

E. M. DELHAAS

Summary
The Seldinger technique was developed using a plastic introducer through which introduction and manipulations of a silicone spinal catheter, an extradural stimulation lead or a small diameter fibreoptic scope are possible without the risk of damage to the vulnerable devices. It is not intended as a replacement of the standard technique of introducing a spinal catheter through a Tuohy needle in general anaesthetic practice. Silicone spinal catheters and stimulation leads are used for long-term therapy in intractable chronic pain and spasticity. A fibreoptic scope is used for endoscopic examination of the subarachnoid or extradural space. Using a standard Tuohy needle the soft silicone extradural lead can be damaged easily by manipulations during insertion. For this reason the manufacturer modified the Tuohy needle for extradural silicone lead introduction. The disadvantages of this modified Tuohy needle are: first, difficulty in localization of the extradural space and second, the needle is still unsuitable for use with a subarachnoid silicone catheter or fibreoptic scope.

Advancing a lead for spinal cord stimulation or a small diameter fibreoptic endoscope [3] through a Tuohy needle is potentially hazardous. For this reason, the manufacturer has modified the Tuohy needle for extradural silicone lead introduction. The disadvantages of this modified Tuohy needle for extradural lead introduction are: first, difficulty in localization of the extradural space and second, the needle is still unsuitable for use with a subarachnoid silicone catheter or fibreoptic scope.

When using a paramedian approach for subarachnoid catheterization, less damage to the catheter can be expected than with the classic median approach. However, the risk of damage to the catheter cannot be completely avoided.

This study was designed to determine the usefulness of the Seldinger technique [4] which allows insertion of a catheter, lead or fibreoptic scope through a plastic sheath into the subarachnoid space.

Methods and results
Local Ethics Committee approval and informed patient consent were obtained. The efficacy of the Seldinger technique for subarachnoid and extradural insertion was studied 25 times in 18 patients (14 with a subarachnoid catheter, two with an extradural stimulation lead and nine with a small diameter fibreoptic endoscope).

With the patient in the lateral position, using the median or paramedian approach, a lumbar puncture with a Tuohy needle (Perican 16 G, B. Braun Melsungen AG, Melsungen, Germany) was performed. A commercially available vascular introduction kit (Check-Flo II Introduction Set 5 Fr, William Cook Europe A/S, Bjaeverskov, Denmark) was used for the Seldinger technique. Under fluoroscopic control a guide wire was advanced through the needle 5–10 cm into the subarachnoid space. By sliding it over the guide wire, the Tuohy needle was removed. The plastic catheter sheath with the dilator was then advanced over the guide wire. Successively the guide wire and dilator were removed. Through the sheath the spinal catheter (Implantable Spinal Catheter 8703 and 8706, Medtronic Inc., Minneapolis, USA), lead (Pisces Quad 3487A, Medtronic Inc., Minneapolis, USA) or a 1.4-mm fibreoptic scope was inserted.

Implanted drug delivery systems are used for managing intractable chronic pain and spasticity with continuous subarachnoid drug infusion [1, 2]. Long-term experience shows a rather high spinal catheter complication rate [2]. One of the problems is damage to the silicone spinal catheter during insertion. This could be caused by the sharp edges of the Tuohy needle and it is possible that this may completely cut the catheter resulting in a catheter segment remaining in the subarachnoid space.

Advancing a lead for spinal cord stimulation or a small diameter fibreoptic endoscope [3] through a Tuohy needle is potentially hazardous. For this reason, the manufacturer has modified the Tuohy needle for extradural silicone lead introduction. The disadvantages of this modified Tuohy needle for extradural lead introduction are: first, difficulty in localization of the extradural space and second, the needle is still unsuitable for use with a subarachnoid silicone catheter or fibreoptic scope.

When using a paramedian approach for subarachnoid catheterization, less damage to the catheter can be expected than with the classic median approach. However, the risk of damage to the catheter cannot be completely avoided.

This study was designed to determine the usefulness of the Seldinger technique [4] which allows insertion of a catheter, lead or fibreoptic scope through a plastic sheath into the subarachnoid space.

Methods and results
Local Ethics Committee approval and informed patient consent were obtained. The efficacy of the Seldinger technique for subarachnoid and extradural insertion was studied 25 times in 18 patients (14 with a subarachnoid catheter, two with an extradural stimulation lead and nine with a small diameter fibreoptic endoscope).

With the patient in the lateral position, using the median or paramedian approach, a lumbar puncture with a Tuohy needle (Perican 16 G, B. Braun Melsungen AG, Melsungen, Germany) was performed. A commercially available vascular introduction kit (Check-Flo II Introduction Set 5 Fr, William Cook Europe A/S, Bjaeverskov, Denmark) was used for the Seldinger technique. Under fluoroscopic control a guide wire was advanced through the needle 5–10 cm into the subarachnoid space. By sliding it over the guide wire, the Tuohy needle was removed. The plastic catheter sheath with the dilator was then advanced over the guide wire. Successively the guide wire and dilator were removed. Through the sheath the spinal catheter (Implantable Spinal Catheter 8703 and 8706, Medtronic Inc., Minneapolis, USA), lead (Pisces Quad 3487A, Medtronic Inc., Minneapolis, USA) or a 1.4-mm fibreoptic scope was inserted.
fibreoptic endoscope (Olympus Europe, Hamburg, Germany) could then be introduced easily. In four cases post-spinal headaches were observed, which were treated successfully with a homologous blood patch. No other complications were observed.

Comment
This study has indicated that the Seldinger technique is an effective method of inserting an extradural catheter, lead or fibrescope into the subarachnoid space. When a Tuohy needle is used for subarachnoid cannulation, the sharp needle edges are potentially damaging. In particular, retrograde movements through the needle have to be avoided. When these movements are necessary it is strongly advised to remove the Tuohy needle together with the catheter and to repeat the lumbar puncture. This can be difficult in severely spastic patients. Furthermore, re-insertion of the rather large diameter Tuohy needle increases the risk of CSF leakage. The most important advantage of the Seldinger technique is that frequent manipulations through the plastic introducer in fibreoptic spinaloscopy and in difficult subarachnoid catheter and extradural lead insertion can now be performed without adverse effects to the apparatus.

With the modified Tuohy needle (Pisces Quad 3487A, Medtronic Inc., Minneapolis, USA) introduction of a stimulation lead in the extradural space is hampered. By using the Seldinger technique, a standard Tuohy needle is used and the extradural space can be identified easily with the loss of resistance method.

The use of the plastic sheath in the Seldinger technique is very important. It protects the fibreoptic scope during multidirectional manipulations. Introduction of a plastic sheath with its silicone membrane into the spinal space gives far superior control on CSF fluid loss. A frustrating complication of chronic spinal drug delivery systems is disconnection of the two spinal catheter parts [2]. A single piece spinal catheter with a plastic introducer sheath which may be split and removed is in the process of development.

Spinal puncture with a Tuohy needle has a high incidence of post-spinal headache [2]. The incidence of spinal headache in our patients treated with the Seldinger technique was similar to that using the classic Tuohy needle spinal puncture technique. The use of a guide wire in the Seldinger technique does not differ from the original technique of introducing a spinal silicone catheter and seems therefore to be an acceptable technique.

The technique is thought to be atraumatic and hopefully may lead to a reduction in catheter morbidity in long-term use. There were no short- or long-term neurological sequelae in the patients reported here. Further studies in this area would be valuable.

Acknowledgements
We thank Olympus Optical Europe, Hamburg, Germany, for the supply of the small diameter fibreoptic endoscope and Medtronic Inc., Kerkrade, The Netherlands for the implantable spinal catheter 8706.

References