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Technical Note

Radioisotopic control for baclofen pump catheter failure

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Study design: Case report of Baclofen pump catheter failure investigated by radioisotope injection.
Objectives: To report a safe and reliable method for evaluating catheter dysfunction.
Setting: France.
Methods: Single case report of failure of Baclofen pump investigated by radioisotope injection.
Results: The injection demonstrated the block in the catheter. The catheter failure was not visualised by plain X-ray nor by filling the pump with radio-opaque solution.
Conclusion: Catheter failure is a common cause of intrathecal drug delivery problems and may be difficult to diagnose. When catheter disconnection, kink, or dislodgement is not visible on X-ray, radioisotopic control is a safe and reliable method for assessment.
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Keywords: baclofen; spasticity; intrathecal drug infusion; complication

Introduction

For more than 10 years, intrathecal baclofen has proven to be a reliable option for the management of spinal spasticity.[1] Complications associated with intrathecal baclofen are often due to technical problems. The drug pump system may not be operating effectively because of mechanical failure of the pump delivery system, or because of catheter failure. The most common cause of dysfunction seems to be the catheter. Previous studies have found catheter malfunction occurring at rates varying from 10% to 40%.[2,3] Kink and perforation represent 50% of the causes of catheter malfunction. A plain X-ray is usually enough to show a dislodgement or a kink. However, leakage or small perforations are more difficult to diagnose. A bolus of radio-opaque material cannot give any information on the presence of solution in the catheter, considering the dilution ratio. Radionuclide flow studies have been described in the literature to evaluate drug pump delivery systems and seems to be a reliable method to evaluate the patency of the catheter.[4]

In this case report, we would like to report a case of baclofen pump failure which required a radioisotopic control (with Indium 111 DTPA) to identify catheter dysfunction.

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Case description

A 24-year-old man involved in a road traffic accident in March 1991, suffered a complete sensory and motor D9 paraplegia. The patient's spasticity worsened over the 3 years following the accident, up to the point that it complicated personal care, made wheelchair positioning difficult, and contributed to frequent skin breakdown. Ashworth scores for the lower extremity muscles were 4. Oral baclofen, 90 mg divided in three daily doses, was inadequate to control spasticity.

In June 1994, following a successful trial of 100 μg intrathecal baclofen, a subcutaneous pump and intrathecal catheter delivery system was placed to administer baclofen. The implanted pump (Synchromod, Model 8723, Medtronic Inc., Minneapolis, USA) was filled with 18 ml of the drug in a concentration of 2000 μg/ml. The intrathecal dose was slowly increased to a daily dose of 380 μg, with good spasticity control. Typical Ashworth scores were 1, wheelchair positioning became easier without any help, and skin breakdown improved. The pump device was refilled at intervals of 3 months.

In July 1995, an increase of spasticity was observed and the patient was admitted to the department. The plain X-ray showed dislodgement of the catheter and the catheter was replaced surgically, resulting in good spasticity control. One month later, spasticity increased again. No source of nociceptive responses

could be found. A plain X-ray showed the catheter in place, with no kink, disconnection or dislodgement. Checking of the pump-rotor movement demonstrated adequate pump function. The patient still responded to treatment because the spasticity clearly improved after a 100 μg injection of intrathecal baclofen by lumbar puncture.

Filling up the pump with 10 ml of a radio-opaque solution (Iopamiron) and three bolus deliveries of 0.5 ml did not provide any information, because the radiologic solution could not be detected, either at the catheter tip, or at a possible site of catheter dysfunction. Furthermore, because of the usual radio-opacity of the implanted catheter, it was not possible to detect the infusion of the solution. Radionuclide control was performed by injection of 500 μ Curie of Indium 111 DTPA diluted with 10 ml of 0.9% saline solution into the drug reservoir of the pump device. In order to avoid overdose, the reservoir was emptied before injecting the radionuclide. The pump was not stopped and static images of the pump device and the catheter tract were scanned over the 24 h of study (at 20 min, 40 min, 6 h and finally 24 h after injection, Figure 1). As shown in Figure 1, the pump and the proximal catheter were clearly visualised at 6 and 24 h. No activity was seen beyond the proximal catheter. After surgical replacement of the catheter, treatment was continued with the same dosage as before. The reservoir was refilled with baclofen and the spasticity decreased immediately. In order to confirm that the pump system was functioning properly, the pump was filled with radioisotopic solution after replacement of the catheter. As shown in Figure 2, there is a 'normal' flow of the radiopharmaceutical solution from the pump, to the catheter into the subarachnoid space and the cerebral cisterns.

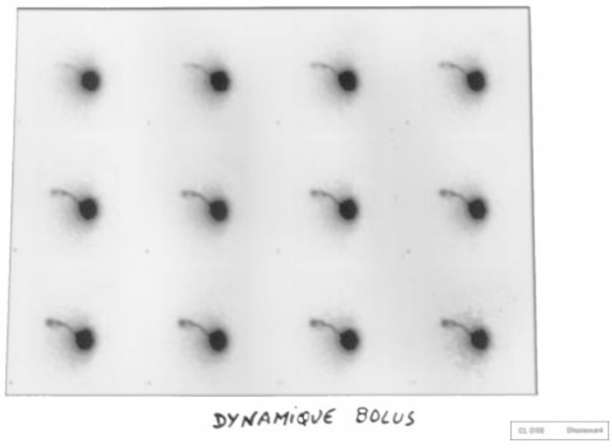

Figure 1 Obstructed catheter. The pump and the proximal catheter are clearly visualised 24 h after the injection of Indium-111 DTPA. No flow is seen beyond the proximal catheter

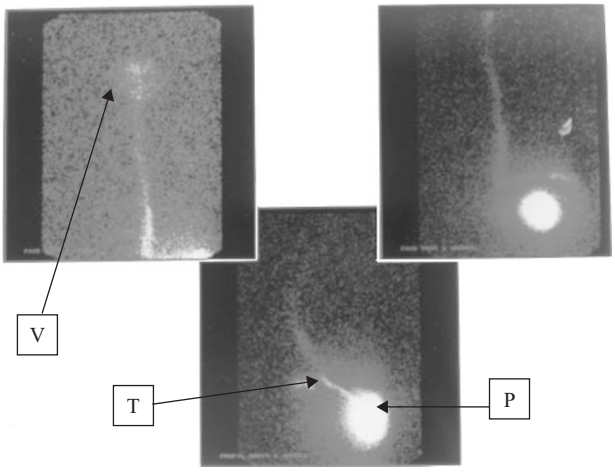

Figure 2 Control of the pump and catheter system. The pump and the catheter are seen clearly as well as the flow into the subarachnoid space and the ventricular system. V = ventricles; T = tip of the catheter; P = pump

Discussion

The management of spasticity by intrathecal baclofen, described by Penn,[1] has been widely used and long term follow-up results are now available.[5,6] Catheter malfunction with an implanted pump is common and has been reported to occur in up to 40% of patients. As reported in previous studies, kinks and holes were found in the distal catheter and represent almost 50% of the catheter malfunctions.[7] Disconnection, dislodgement into the subarachnoid space, and fibrosis are less common but need to be addressed. Pump failure is often due to battery power failure. The average lifetime after implantation is 49 months.[8]

When baclofen delivery stops, the patient experiences a rebound of his spasticity. An abrupt stop of the delivery may even result in malignant hyperthermia, rhabdomyolisis and disseminated intravascular coagulation similar to neuroleptic malignant syndrome.[9]

The most difficult problem is to delineate the cause of catheter malfunction.[10] An abdominal X-ray can localize a kink, a disconnection or a dislodgement. If the catheter is in place, the clinician may think that baclofen tolerance has occurred. An injection of intrathecal baclofen given by lumbar puncture will demonstrate responsiveness. It enables the clinician to determine if the pump system and the catheter are functioning properly.

Filling the pump with 5–10 ml of radio-opaque solution cannot give information on the presence of the solution in the catheter, because of the dilution ratio. It is impossible to detect radio-opaque solution at the tip of the catheter, as a minimum of 10 ml is usually required to perform a myelogram, considering the dilution ratio. Furthermore, the use of a radiolucent catheter cannot show the radio-opaque solution. The use of an access port (on the recent pump model) does not give better results.

The radioisotopic control with Indium 111 DTPA is very helpful in identifying the underlying problem. As described by Rosenson,[4] the radionuclide technique provides an excellent way to assess these drug pump delivery systems. Serial scans over 24 h can show an obstruction in the catheter. Even if no leakage can be seen, surgical replacement of the catheter solves the problem.

Since our first case report, we have noted other catheter dysfunctions. The access port wasn't helpful because it was impossible to inject all the solution; the obstruction has always been seen by using the radionuclide solution through the pump. After surgical replacement, a new investigation with radionuclide injection can confirm that the pump is functioning normally.

However, Schurch has reported the case of a patient with suspected catheter malfunction, where the diagnosis could not be made according to usual investigations, thus making surgery inevitable. A very small disconnection was discovered at the distal part of the catheter.[10]

From our experience, it appears that in cases of suspected catheter dysfunction: (1) the plain X-ray can localize disconnection, kink or dislodgement; and (2) the radionuclide technique can easily localise obstruction on the catheter, whereas the radio-opaque solution is useless and cannot give any information on the presence of a solution inside the catheter. Even if no leakage can be seen on the catheter but only obstruction, surgical replacement usually solves the problem.

Conclusion

Catheter failure is a common cause of failure of intrathecal drug delivery and is sometimes difficult to diagnose. If neither catheter disconnection, kink or dislodgement are seen on the X-ray, the radioisotopic control with Indium 111 DTPA provides an excellent way to assess obstruction along the catheter. This is a safe and reliable method for evaluating catheter dysfunction.

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