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Case Report

A case of rapid deterioration in sperm quality following spinal cord injury

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Study design: Case report.
Setting: Northwest Regional Spinal Injuries Unit, Southport, UK and Reproductive Medicine Unit, Liverpool Women's Hospital, Liverpool, UK.
Case report: A 28-year-old man suffered from paraplegia on sustaining a fall. Fertility preservation was an important aspect of his treatment and electro-ejaculation and cryopreservation of sperm was possible within days of sustaining the fall. The sperm samples obtained subsequently showed a rapid decline in quality. Frozen sperm from the first normal ejaculate obtained soon after the injury was used for assisted reproduction and has resulted in an ongoing pregnancy.
Conclusion: This case highlights the importance of collection and freezing of seminal fluid within 2 weeks of spinal cord injury (SCI), or earlier to improve fertility outcomes in spinal cord-injured men, as the clinical stability of the patient may allow.
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Introduction

Spinal cord injury (SCI) is not uncommon and is more likely to involve young men. One of the major consequences of such injuries includes compromised fertility and even male infertility. We report a case, where semen sample cryopreserved within a week of the injury provided the couple their only chance of successful assisted conception.

Case report

A 28-year-old man presented to the spinal injuries unit following a recent fall from a height of about 20 ft. He was managed in the intensive care unit of the local hospital, where tetraplegia due to fracture of cervical vertebrae had been diagnosed and supportive treatment commenced. Admission immediately following the fall had shown normal vital signs and diaphragmatic breathing. The Glasgow Coma Scale was normal at 15/15. Neurological examination at this time confirmed a sensory level of C8 (ASIA-A). The patient had complete motor and sensory paralysis at this time. Approximately 24 h after the fall, neurological examination confirmed tetraplegia at cervical spinal level of C7 classified as C7 (ASIA-A).

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X-ray of the spine showed fracture of the body of the 6th cervical vertebra (C6) with bilateral laminar fracture to C6 and a burst fracture involving the body of cervical vertebra (C7).

A CT scan of the spine done later confirmed a vertical fracture of the body, laminar fracture of C6 and a burst fracture of the body of C7 with posterior retropulsion leading to narrowing of the cervical vertebral canal to 50% of its antero-posterior diameter.

The patient was generally a fit young man who smoked about 20 cigarettes/day. The couple had recently suffered an early pregnancy loss and was trying for a conception again.

At 3 days after the fall, while still in the acute phase of the spinal injury, the patient requested freezing of his semen sample for future fertility use, in view of the recent miscarriage and his imminent infertility due to tetraplegia. At this stage, the patient was under continous catheterisation for bladder drainage. Electro-ejaculation was performed within 24 h of the request and this was carried out under light general anesthesia. Before the procedure, the bladder was instilled with 10 ml. of Ham's F-10 culture medium. Electro-ejaculation was performed using Saeger Electroejaculation equipment (Dalzell USA Medical Systems, Dungannon, Northern Ireland). The patient was placed in the lateral decubitus position and a 31 mm diameter probe was

inserted into the rectum. Stimulation was performed using voltage range of 7–35 V each stimulation lasted 2–4 s. Following stimulation, the perineum and bulbous urethra were massaged and the antegrade fraction of the ejaculate was collected in a sterile container. At the end of the procedure, the bladder was recatheterised and the retrograde fraction was recovered. Proctoscopy was performed before and after the procedure to ensure that no thermal injury had been caused to the rectal mucosa.

The semen analysis report on the antegrade ejaculate obtained was as follows:

Volume – 3.2 ml (normal range $\geqslant$2 ml)
pH – 7.7 (normal range $\geqslant$7.2)
Sperm concentration – 70×10^6 million/ml (normal range $\geqslant 20 \times 10^6$/ml)
Motility – 60% (normal range $\geqslant$50% grades A + B)
Progressive motility – 50% (normal range $\geqslant$50% grades A + B)
Cells/high power field – 8 (normal range $\leqslant 5 \times 10^6$/ml).

All the parameters were within the normal range of WHO guidelines that are universally used by all seminology laboratories.

A second electro-ejaculation procedure was undertaken on 14th day after the injury (10 days after the first ejaculate was retrieved) by which time the bladder was being intermittently catheterised to assist evacuation.

Analysis of the second sample however, showed deterioration in the semen quality.

Volume – 1.8 ml (normal range $\geqslant$2 ml)
Sperm concentration – 0.1×10^6 million/ml (normal range $\geqslant 20 \times 10^6$/ml)
Motility – 50% (normal range $\geqslant$50% grades A + B)
Progressive motility – 50% (normal range $\geqslant$50% grades A + B).

In the chronic phase, reflex voiding was the method of bladder management. Approximately 4 months following the injury, repeated midstream urine culture were consistently positive for organisms like *Proteus mirabilis* and *Enterococcus faecalis*. About 18 months following the injury, repeated and spaced electro-ejaculation produced large volumes of ejaculates ranging from 9–15 ml each containing variable quality of sperms ranging from presence of only nonmotile sperms, to only 25% sperms with normal morphology and poor progressive motility of 30%.

The couple underwent six cycles of intra-uterine insemination unsuccessfully. Recently, they underwent IVF-ICSI treatment using sperms from the first frozen ejaculate (cryo-preserved immediately after the injury). Sperms with normal motility obtained from the first sample successfully fertilised 9 of the 10 oocytes collected. The treatment has resulted in the birth of a healthy female child.

Discussion

It is estimated that 10 000 new cases of SCIs are reported annually and about 80% of these injuries involve men in the age group of 18–45 years.[1] One of the major consequences of SCI in these young male patients is infertility. Many of these patients would seek fertility treatment several years after the injury. Less than 5% of these men can procreate without medical intervention.[2] There is poor evidence regarding the time duration after the actual injury that the semen quality in spinal cord injured men begins to deteriorate. The reasons for poor semen quality in spinal-cord injured men is also unclear. Stasis of prostatic fluid, testicular hyperthermia, recurrent urinary tract infections, sperm contact with urine, sperm auto-antibodies and neuro-endocrine changes involving the hypothalamo-pitutary axis, chronic long-term use of various medications and type of bladder management appear to be contributing factors.[3]

In our case, the first semen sample was collected and cryo-preserved 5 days after the injury. This was possible because he was clinically stable and could safely undergo electro-ejaculation. This sample was normal in all respects. However, the second sample obtained 10 days later showed a reduction in the sperm count from 70×10^6 to 0.1×10^6 million/ml, although forward progressive motility remained normal at 50%. Men with SCI are known to show an unusual semen profile with normal sperm concentration and extremely impaired motility.[4] However, our case showed marked decline in sperm concentration within 2 weeks of the injury.

About 15 months later, the quality of ejaculate had worsened considerably showing a population of 28×10^6 million/ml with normal morphology, all of which were non-motile. A similar trend was also noted in our case. This could be a reflection of problems related to methods used for bladder management following spinal injury, amongst other factors. Studies on various methods of bladder management have confirmed that intermittent achieved a higher percentage of motile sperms as compared to high pressure voiding by reflex or straining.[5,6] Ohl *et al*[5] have also concluded that urinary infection is associated with slightly lower-sperm quality and lower-pregnancy rates as compared to presence of sterile urine, 10 *versus* 30%. Decline in semen quality appears to begin within the first few weeks of injury, but the exact point in time when deterioration starts has not yet been determined. Using a canine model, Ohl *et al*[7] demonstrated that decline in semen quality begins 3 weeks after the injury. Mallidis *et al*[8] suggested decline in quality starts within 16 days of injury. Our case also suggests that decline in sperm quality may actually begin within the first 10 days following SCI.

In our case, thawing of the second sample provided only six poorly motile sperms in $20 \times 50\ \mu$l drops, which were unsuitable for IVF/ICSI treatment. This could be either due to reduced quality of sperm at the time of collection or decline in motility due to freezing. Since a similar decline was not seen in the first sample, it is more likely to have resulted from decline in quality (at the time of collection) 14 days following SCI.

This case highlights the importance of collection and freezing of seminal fluid within 2 weeks of SCI to

improve fertility outcomes in spinal cord-injured men. However, this may not be possible unless the patient is clinically stable.

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