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A simple technique to prevent retrograde ejaculation during assisted ejaculation

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The aim of this study was to develop a technique which would prevent retrograde ejaculation in chronic spinal cord injured (SCI) patients undergoing vibration and electroejaculation procedures. A balloon catheter was used to tamponade the bladder neck in 12 patients who underwent 100 assisted ejaculation procedures. Antegrade ejaculations were collected on all occasions with no incidences of urine contamination and no sperm were seen in post ejaculatory urine. Silicone catheters had minimal effects on sperm motility and viability. All lubricant gels were found to adversely affect sperm quality and were not used.

Keywords: assisted ejaculation; retrograde ejaculation; spinal cord injury; infertility.

Introduction

It is well recognised that semen quality in men with long standing spinal cord injury (SCI) is poor and characterised by small volumes, variable counts and in particular, poor motility.[1,2] The semen may improve with repeated use of assisted ejaculation techniques—electroejaculation (EE) or vibration ejaculation (VE)—though it rarely reaches levels found in healthy, nondisabled men.[3]

Linsenmeyer & Perkash[4] have listed a large number of factors that may contribute to poor semen quality including stasis of prostatic fluid, testicular hyperthermia, recurrent urinary tract infections, abnormal testicular histology, possible changes in the hypothalamic–pituitary–testicular axis, possible sperm antibodies, some medications and the type of bladder management. Other factors are also of significance, particularly retrograde ejaculation or partial retrograde ejaculation and the contamination of semen by urine during antegrade ejaculation.[5]

The incidence of retrograde ejaculation in chronic SCI has been reported at between 9% and 41%.[1–3,6] In these patients, sperm can be retrieved from the urine, but the procedure involves a complicated process of preparation requiring either the alteration of pH and osmolarity of the urine or emptying of the bladder by catheter before instilling a buffered solution or culture medium.

Warner *et al*[6] have described a complex technique of modifying commercially available catheters to prevent retrograde ejaculation. An inflated balloon acted as a 'ball-cock valve' blocking urine flow from the bladder into the prostatic urethra and preventing semen entering the bladder. A number 18, siliconised rubber, three-way Foley catheter had the bladder ports in the urinary lumen blocked with silicone rubber. The irrigation port was left open. Additional ports for semen to enter the urinary lumen were cut into the portion of the catheter which would reside in the prostatic urethra. It is interesting to note that

although they reported a moderate degree of success with this particular method, in later publications the same group of workers[7] had dispensed with this catheter technique and were using post-ejaculation bladder flushes.

Rawicki & Hill[8] briefly noted the use of balloon catheter bladder tamponade in three patients to prevent retrograde ejaculation during assisted ejaculation. We use a similar method. The simple technique is described. Also, commonly used lubricants and catheters were studied to determine their effects on sperm.

Materials and methods

Assisted ejaculation

Patients

All patients volunteered for inclusion in the study. Prior to each procedure being performed, the technique was explained to the patient and a consent form completed. Twelve men with SCI (Table I) aged 21–36 (mean 31) years were treated with assisted ejaculation techniques at the Austin Hospital Spinal Injuries Unit. The procedures were performed 1–24 (mean 8) years after the injury.

Electroejaculation procedure

In all patients, a 14 French gauge one-way 100% silicone Foley catheter was introduced into the bladder by sterile technique and its balloon filled with 10 ml of normal saline. The use of lubricants was avoided because of their harmful effects on sperm.[9] The 'stickiness' of the catheter material and the flexibility of the Foley catheters made insertion difficult. This was overcome by injecting normal saline directly into the urethra with a syringe. A Twomey syringe with 50 ml normal saline was connected to the distal end of the Foley catheter. An assistant gently infused the urethral passage with a continuous flow of normal saline as the catheter was inserted. This provided lubrication between the urethral mucosa and the catheter. Urine was drained and the balloon inflated with 10 ml of normal saline. The assistant gently pulled on the catheter so the inflated balloon tamponaded the bladder neck (Fig 1). We did not use a weighted traction device as described by Warner *et al*.[6]

A rechargeable, battery-powered electrical stimulator (Fig 2), the 'CGS Electrojector' (Ratek Industries P/L), provided a progressively increasing sine wave current at 20 Hertz to a maximum of 16 volts and 500

Table I Physical information, type of bladder management and assisted ejaculation procedure

Subjects	Month/Year of injury	Level	Bladder management	Procedure
1	4/68	C4(C)	Reflex	EE[a]
2	1/69	C4(C)	Reflex	VE[a]
3	6/77	C6(C)	Reflex	EE & VE[a]
4	11/81	C6(C)	Reflex & EUS	EE & VE[a]
5	4/84	T11(C)	Straining	EE
6	12/85	T10(C)	Reflex	EE
7	12/86	T11(C)	Reflex & EUS	EE
8	12/87	T10(C)	ICSC	EE
9	3/88	T12(I) L2(C)	Reflex	EE/GA
10	7/88	C5(I) C6(C)	Reflex & EUS	VE[a]
11	1/90	T8(C)	ICSC	EE
12	1/91	T6(C)	Reflex & EUS	VE

[a]Nifedine prophylaxis used.
EUS = external urethral sphincterotomy.
ICSC = intermittent clean self catheterisation.
EE/GA = electroejaculation performed under general anaesthesia.

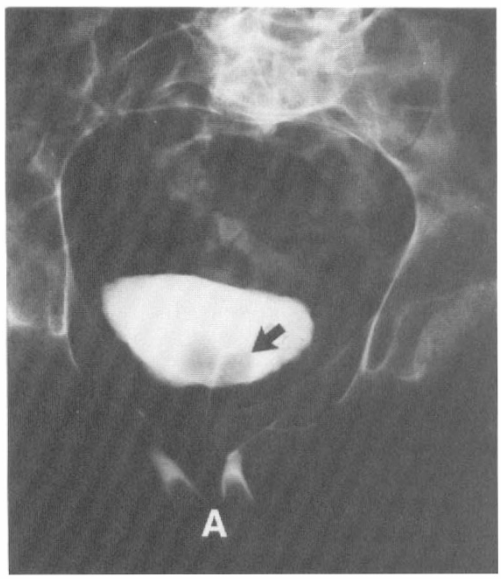

Figure 1 Foley catheter tamponading the bladder neck. The arrow indicates the balloon of the catheter opposed to the bladder neck. 'A' indicates incidental bilateral penile implants.

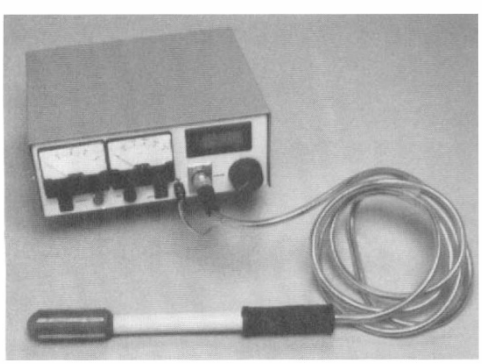

Figure 2 CGS Electrojector and probe.

milliamps. The Delrin probe has three longitudinal, anteriorly placed, stainless steel, bar electrodes. The probe is blunt at the tip and a thermocouple in the middle electrode monitors temperature at the electrode–mucosal interface. The temperature is shown on an LED screen built into the stimulator.

Proctoscopy was performed to determine the health of the rectal mucosa before the rectal probe was inserted. The stimulator output was progressively increased to the maximum voltage (16 V) or until ejaculation occurred. Stimulation ceased if the temperature reached 40 °C. Emission of semen occurred through the urethra around the catheter. Semen was collected in a warm sterile plastic jar. Proctoscopy was repeated after the procedure and the catheter was removed.

To determine the adequacy of bladder neck tamponade, urine was collected following the procedure. This practice was discontinued after the first three EEs on each patient, as there was no sperm in the urine.

Vibration ejaculation

After catheterisation (as above), ejaculation was induced with a commercially available domestic vibrator (Jeou Jen Electric Co) at 60 Hertz. The procedure was similar to that described by Brindley.[1]

Semen analysis

The ejaculate volume was measured in a graduated syringe after liquefaction. Sperm concentration was measured in a haemocytometer chamber using the appropriate dilution.[10] Sperm morphology was assessed from smears stained using the Shorr procedure, with 200 sperm being graded according to criteria previously described.[11] The percentage of motile sperm was assessed by the method described below.

Effect of catheters and lubricants on sperm
Patients

Samples were provided by five men being investigated for infertility. Specimens were collected at the laboratory by masturbation into a sterile plastic container after a recommended minimum period of abstinence of 3 days. Normal and abnormal specimens were selected for this study to cover the spectrum of sperm quality in patients with SCI.

Catheters and lubricants

Three compositions of Foley '14 French gauge-5cc' catheters were selected for study: All latex (Bardex®: C.R. Bard Inc), silicone-coated latex (Bardia®: C.R Bard Inc.)

and all silicone (Argyle®: Sherwood Medical; Bardex®: C.R Bard Inc.; Curity®: The Kendall Co. and 4 Sure®: Boston & Pacific Co). The lubricants chosen were the most widely used preparations: Petroleum jelly (Vaseline®, Chesebrough Ponds International Ltd), K-Y® jelly (Johnson & Johnson Ltd), Surgilube® (Fougera & Co).

A 1 mm thick cross section of each catheter was placed into separate sterile plastic tubes. Using a sterile spatula a small quantity of each lubricant was spread onto the bottom of sterile plastic test tubes to form a thin coating. A 0.2 ml aliquot of semen was added to each tube. The tubes were placed into an incubator (35 °C) fitted with a moving tray which gently mixed the semen for 30 minutes. Positive and negative controls were repectively: 1 mm sections of latex glove which is known to completely immobilise sperm,[12] and a tube containing only semen.

Motility analysis

Computer assessment

The Hamilton-Thorn Motility Analyser was used to assess the motility characteristics of each sample. The procedure involves the placing of a 5 μl aliquot of semen into a 10 μm-deep Makler chamber at 37 °C and loading the chamber into the instrument. The following were measured: average path speed (VAP in μm/s), mean curvilinear speed (VCL), mean straight line speed (VSL), mean linearity (LIN), mean straightness (STR), mean amplitude of lateral head displacement (ALH) and mean beat cross frequency (BCF). Also measured were the percentages of motile sperm with VAP in different ranges: total progressive (VAP > 10 μm/s) and those with rapid (VAP > 30 μm/s), medium ($10 <$ VAP < 30), slow ($0 <$ VAP < 10), static (VAP $= 0$) speed. The analyses were performed at the settings previously described.[13] For each specimen an average of nine fields (range 4–18) having a mean number of 354 spermatozoa (range 105–804) was studied.

Manual assessment

The percentage of motile sperm was determined by microscopic examination ($\times$ 400) of 7 μl of semen placed on a warm (37 °C) glass slide and covered with a glass coverslip (22 mm $\times$ 22 mm). At least 200 sperm were counted and graded according to the WHO[10] criteria. Nonmotile sperm were assigned a score of zero; motile sperm were graded as: 1 (no forward progression), 2 (forward progression) and 3 (rapid, linear, forward progression). Progression was assessed subjectively with fast forward progression being defined as rapid, straight line movement. The motility index[14] was calculated by adding the product of the grade and the percentage of sperm in that grade. Semen samples without specific motility disorders have a motility index (MI) of about twice the percentage motility. The manual percentage motility is higher than the computer measuerement because the computer only counts as motile those sperm with a VAP > 10 μm/s.

Sperm viability (SV)

The percentage of dead sperm was determined using the eosin Y wet method,[15] which is based on the principle that dead sperm with damaged plasma membranes take up stain.

Statistical analysis

The data were compared by two way analysis of variance (ANOVA) and comparison of differences of the means for the control and experimental samples using the least significant difference method. Calculations were performed using the Statistical Package for Interactive Data Analysis (Statistical Computing laboratory, Macquarie University, Australia).

Results

Assisted ejaculation

Over a period of 26 months, a total of 100 procedures (84 EE and 16 VE) were performed, with each patient undergoing between one and 23 assisted ejaculations. Both VE and EE procedures were usually completed within 20 minutes and resulted in antegrade ejaculations being collected from

all patients. No incidences of severe hypertension due to autonomic dysreflexia or visually apparent urine contamination of the semen were noted. Post EE proctoscopy showed no damage to the rectal mucosa of any patient.

A wide variation in semen quality was found both between patients and in samples collected from the same patient (Table II). In 92% of cases, the first sample produced at least three semen characteristics below the recommended normal range[10]: 92% of first samples had either semen volumes less than 2 ml or less than 30% of sperm with normal morphology or less than 40% motile sperm. 59% had sperm concentrations below 20 million per ml. Subsequent samples showed a marked improvement in semen quality with 60% of patients producing specimens with increased sperm concentrations and 50% having either semen volume, percentage motile sperm or percentage of sperm with normal forms exceeding the lower limit of the normal range. The greatest differences seen were in sperm motility, where the first sample of 10 of the 12 patients contained less than 10% motile sperm, seven having no motile sperm. Subsequent samples from nine of the 10 patients who underwent the procedure on a number occasions, were found to have sperm motilities greater than 30%. The one patient (number 4, Table II) who showed no improvement had severe hypospermatogenesis on testicular biopsy. Two patients (numbers 3 and 4) underwent EE after successful VE, due to fears that vibratory stimulation might induce uncontrollable autonomic dysreflexia. Ejaculate volumes and sperm concentrations collected by EE were greater than those obtained by VE. No difference in sperm motility was found between the two methods.

Complications

One patient had significant problems with recurrent urinary tract infections (enterococcus faecalis) which were detected in post EE urine samples. The only other difficulty encountered was a patient with incomplete low level paraplegia who complained of severe stomach cramps during the EE procedure. As even low voltages caused discomfort, subsequent EEs were performed under general anaesthesia and have resulted in the collection of satisfactory specimens.

Effect of catheters and lubricants on sperm

All catheters except 4 Sure® significantly decreased the manually assessed motility and MI below those for the control specimens (Table III). The all latex (Bardex®)

Table II Range of semen characteristics for each patient

Subjects	No. of Specimens	Volume (ml)	Concentration (10^6/ml)	Motility (%)	Progress motility (%)	Normal forms (%)
1	1	5.5	82	1	ND[a]	10
2	1	0.4	9	4	4	14
3	5	0.5–1	500–1970	10–32	8–21	21–23
4	4	1.2–1.9	0–2	0–10	0–8	10
5	23	0.5–4.0	2–576	0–80	0–64	11–46
6	15	0.1–4.0	1–236	4–55	3–40	6–20
7	17	0.1–2.8	0–4	0–45	0–36	1–40
8	11	0.2–3.5	286–965	0–30	0–24	5–30
9	13	1–8.5	1–54	0–40	0–38	6–19
10	2	0.5–1.2	305–500	0–50	0–4	10–15
11	4	0.1–0.2	42–400	0–30	0–24	10–20
12	4	0.5–1.4	0–8	0–50	ND	20–30
Normal range		> 2.0	> 20	> 40	> 25	> 30

[a]ND = not done.

Table III Mean characteristics of semen exposed to different catheter materials and lubricating gels

	% Motility (manual)	MI	Alive (%)	% Motility (computer)	VCL (m/s)	VAP (m/s)	VSL (m/s)	RAP (%)	MED (%)	LIN (%)	STR (%)	ALH (m)	BCF (Hz)
Bardex (latex)	41.0[a]	59.8[b]	53.8	10.6[a]	33.4[a]	28.0[a]	20.8[a]	5.4[a]	5.2[a]	60.4	71.8	1.02[a]	3.64[a]
Bardia	41.6[a]	64.4[a]	58.4	13.4	38.2	31.0	24.2	8.7	5.0[a]	63.6	77.6	1.94	8.02[a]
Argyle	43.8[a]	66.0[a]	59.2	23.0	41.0	31.8	23.6	13.8	9.2	59.8	76.6	2.12	7.36
Bardex (silicone)	42.2[a]	63.0[a]	55.4	22.4	39.6	32.6	25.6	14.2	8.2	65.2	77.4	1.70	6.80
Curity	41.4[a]	61.4[b]	56.8	23.2	42.0	33.4	26.0	14.8	8.2	62.8	77.8	1.84	7.46
4 Sure	46.0	71.2	54.2	27.4	44.6	34.8	26.0	17.4	10.0	60.6	75.4	1.72	6.00
Vaseline	43.6[a]	63.8[a]	54.6	14.4	38.0	31.2	25.2	8.0	6.2	68.6[a]	80.4[a]	1.58	6.54
K-Y jelly	30.2[c]	48.8[c]	49.0[b]	10.4[a]	26.2[c]	24.4[b]	22.0	4.4[a]	6.0	83.4[c]	90.2[c]	1.18	7.92[a]
Surgilube	39.2[b]	61.4[b]	55.8	9.8[a]	29.4[b]	24.6[b]	20.4[a]	3.4[b]	6.4	71.4[b]	83.0[b]	1.32	7.22
Glove	0[c]	0[c]	12.8[c]	0[c]	0[c]	0[c]	0[c]	0[c]	0[c]	—	—	—	—
Semen	51.8	82.4	61.0	22.8	40.2	32.4	24.2	14.0	9.2	61.8	75.4	1.74	6.00

[a] $p < 0.05$, [b] $p < 0.01$, [c] $p < 0.001$

catheter was also found to significantly lower the computer assessed motility measurements–VAP, VCL, VSL, ALH and BCF. The only other difference noted was that the silicone coated latex (Bardia®) catheter significantly decreased the percentage of sperm with medium speed but increased the BCF. SV was not affected significantly by any of the catheters.

All the lubricants tested were found to decrease manually assessed motility and MI, but to increase LIN and STR. Sperm placed in the aqueous gels (K-Y jelly® and Surgilube®) were also found to have significantly lower computer asessed total progressive motility, VAP, rapid speed and VCL than for the control specimen. In addition, K-Y jelly® caused a significant decrease of SV and increase of BCF. Surgilube® also significantly decreased VSL.

Discussion

Male infertility due to ejaculatory dysfunction is a major problem associated with chronic SCI. Although assisted ejaculation techniques, such as EE and VE, have provided a means of collecting semen from men with SCI, partial or complete retrograde ejaculation is common. To prevent the detrimental effects of urine on already compromised semen and to circumvent the complicated procedures involved in sperm retrieval from the bladder, we used the simple technique of balloon catheter bladder neck tamponade.

The addition of this technique to our assisted ejaculation protocols resulted in the collection of antegrade ejaculations from all patients. The lack of urine contamination and the absence of sperm from post ejaculatory urine, indicated that the catheter had successfully tamponaded the bladder neck. The procedure caused minimal inconvenience to the patients, most being accustomed to catheterisation as part of their bladder training. No serious complications were encountered with the procedures, although early in the study one patient had recurrent urinary tract infections following EE.

All but one of the catheters tested were found to significantly decrease manually

assessed motility and MI. The finding that the 4 Sure® catheter did not cause any changes to the sperm motility, suggests that the damage caused by the other three 100% silicone catheters, may not be due to the silicone base but rather to other factors such as coatings applied to the outside of the catheters. Considering the dramatic effect of the latex glove on sperm movement and viability, the finding that the all-latex catheter affected almost every aspect of sperm motility was not surprising. The application of a silicone coating appeared to reduce this problem. The all silicone catheters were selected for use in our procedure because they caused the least reduction in sperm motility and were easily inserted.

The use of lubricants is a common element in catheterisation. However, for semen collection, it is recommend that lubricating gels (especially petroleum based) are avoided because of their deleterious effect on sperm survival and motility.[9,10] These studies showed that the petroleum based gel (Vaseline®) decreased only the manually assessed motility. Yet the aqueous based lubricants, which are most often recommended by infertility clinics, adversely affected almost all the sperm characteristics measured. All the lubricants tested were found to significantly increase mean linearity and mean straightness, a not unexpected result as the viscosity of the gels would cause the sperm to swim in a more linear fashion with a higher beat cross frequency to maintain forward progression. But only K-Y jelly® showed a significant difference from the control specimen. Processing semen samples which have come into contact with lubricants may be difficult because the gels concentrate in the centrifuged sperm pellet. Thus we decided to avoid the use of conventional lubricants.

The quality and quantity of the initial semen samples collected from our patients were comparable to those of other studies: low volumes, variable sperm concentrations and poor sperm motility. Our observations agree with the studies of Brindley[1] who reported that in chronic SCI patients, the first sample collected was generally poor but with successive ejaculations there was a tendency for the quality to improve. These variations in semen quality probably occur because of the inability of chronic SCI patients to ejaculate. When assisted ejaculation procedures are performed on these patients, the first sample collected usually contains large numbers of dead and degenerating sperm which have accumulated in the genital tract over time. Successive ejaculations empty the reserves of aged sperm allowing the epididymis to be replenished by young, viable sperm with increased motility.

Conclusions

Tamponading the bladder neck by balloon catheter was found to be an easy, quick and safe method of preventing retrograde ejaculation during assisted ejaculation procedures. Conventional lubricants for catheterisation should be avoided because they impair sperm motility and make processing sperm difficult. Silicone catheters should be chosen for the procedure because of their minimal effect on sperm and ease of use.

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