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Sperm content of pre-ejaculatory fluid

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Abstract

This study was designed to establish whether motile spermatozoa are released with pre-ejaculatory fluid and whether this fluid therefore poses a risk for unintended pregnancy. Forty samples of pre-ejaculatory fluid were examined from 27 volunteer men. Samples were obtained by masturbation and by touching the end of the penis with a Petri dish prior to ejaculation. Eleven of the 27 subjects (41%) produced pre-ejaculatory samples that contained spermatozoa and in 10 of these cases (37%), a reasonable proportion of the sperm was motile. The volunteers produced on up to five separate occasions and sperms were found in either all or none of their pre-ejaculatory samples. Hence, condoms should continue to be used from the first moment of genital contact, although it may be that some men, less likely to leak spermatozoa in their pre-ejaculatory fluid, are able to practice coitus interruptus more successfully than others.

Keywords

Male fertility; contraception; male reproductive system

Introduction

Pre-ejaculatory fluid is released from the male urethra in amounts of up to 4 ml during sexual arousal, prior to ejaculation. It is said to originate from Cowper's glands and the Glands of Littre, which open at different sites along the length of the urethra. These glands secrete an alkaline fluid containing numerous enzymes and mucus but no sperm. Despite this lack of sperm, current advice is that any fluid emanating from the penis prior to ejaculation could be contaminated with sperm and therefore should be regarded as potentially fertile and capable of resulting in an unwanted pregnancy. Indeed, the NHS Choices website (2010) states that 'Millions of sperm are also found in the liquid produced by the penis as soon as it is erect (hard). This means that a man doesn't have to ejaculate for pregnancy to occur'. Identical statements are found on many other websites. Guidelines therefore recommend condom use from the very first moment of sexual contact (NHS

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Authors' contributions

Stephen Killick was responsible for the study design and writing the article. Christine Leary collected the data and performed the laboratory assessments. James Trussell performed the literature search, interpreted the data and contributed in writing the article. Katherine Guthrie had the original idea and contributed in writing the article.

Clinical Knowledge Summaries, 2010) and limit the opportunity for foreplay, hence reducing the popularity of condom use.

Nearly 60% of women aged 15–44 in the USA who have ever had intercourse have used *coitus interruptus* (withdrawal) as a form of contraception at some time, and among women at risk of unintended pregnancy, 4.6% use withdrawal as their primary method and a further 4.4% use withdrawal plus another method (Mosher & Jones, 2010). In the UK, 5% of women at risk for unintended pregnancy use withdrawal (Lader, 2009). Guidelines for withdrawal (Withdrawal Method. Planned Parenthood, 2004) recommend withdrawing the penis from the vagina when the man feels ejaculation is imminent, but it is not remotely clear how a man would know when he is leaking pre-ejaculatory fluid or indeed spermatozoa.

The source for the claim that pre-ejaculatory fluid contains sperm is entirely unclear. Masters and Johnson stated in *Human Sexual Response* that there were ‘large numbers of active spermatozoa in the pre-ejaculatory secretion’. However, they were unable to produce data to substantiate that claim (Masters & Johnson, 1966). In fact, to date, no study has found motile sperm in the pre-ejaculate.

This study was designed to establish whether motile spermatozoa are indeed released with pre-ejaculatory fluid and therefore whether the fluid poses a risk for unintended pregnancy.

Method

Male volunteers were recruited by poster advertisements around a university, in a city-centre drop-in clinic, and by word of mouth. Subjects were asked to attend the local IVF unit and given private facilities to produce a sample of semen by masturbation. They were given clear and specific instructions, both verbally and in writing, about collecting a sample of any fluid appearing at the tip of the penis before ejaculation by touching the end of the penis with the base of a Petri dish.

Note was taken of the time since last ejaculation and any significant general health factors. Subjects were allowed to produce up to five samples on different occasions at least three days apart.

Pre-ejaculatory fluid samples were examined as soon as possible after production (within 2 min) and volumes measured with a graduated pipette. Petri dishes were scanned using inverted, phase contrast 400 × light microscopy, thus allowing the full sample to be analysed for the presence of any sperm and for their motility to be assessed. The tiny samples were subsequently hydrated with 100 µl of culture medium to permit the analysis of cell and sperm concentrations using a standard haemocytometer. Ejaculatory samples were submitted to standard WHO analysis (World Health Organization, 2010). See Table I.

Ethical approval was obtained from the Hull and East Riding Local Research Ethics Committee and formal written consent obtained from each subject. Data analysis was conducted in Excel.

Results

Twenty-eight subjects volunteered for the study but one admitted to being unable to collect his pre-ejaculatory fluid, leaving 27 subjects and 40 samples of both pre-ejaculatory and ejaculatory fluid for analysis. Results for each sample are shown in Table II.

Eleven of the 27 subjects (41%) produced pre-ejaculatory samples that contained spermatozoa and in 10 of these cases (37%) a reasonable proportion of the sperm was motile. In every case where an individual subject produced more than one sample, he either did or did not have spermatozoa in all of his samples. In other words, it was never the case that a subject sometimes had spermatozoa and sometimes did not.

Four of the volunteers were found to be oligospermic (subjects 11, 16, 22 and 25). Each was advised of his condition and given appropriate counselling and guidance with regard to his future fertility potential. In two cases, the cause of oligospermia was almost certainly concomitant drug therapy. Interestingly, all these 4 oligospermic individuals produced motile sperm in their pre-ejaculatory samples.

In most cases, the sperm concentration and percentage of motile sperm were similar in an individual's pre-ejaculatory and ejaculatory specimens (Figure 1, correlation =0.44) and in one case (subject 11) when a subject produced ejaculatory samples of variable concentration (very probably related to his drug therapy) the concentration in the pre-ejaculatory sample mirrored these changes. Nevertheless, it is important to note that pre-ejaculatory and ejaculatory samples appeared different. Pre-ejaculatory samples tended to be more cellular and in only 3 of the 40 paired samples were sperm concentration and motility identical.

Discussion

The importance of the fertilising potential of pre-ejaculatory fluid in the eyes of the general public is illustrated by fact that a Google search under the term 'pre-cum' (the customary slang word for pre-ejaculatory fluid and not a dictionary word or a word used in any other context) revealed no fewer than 7,440,000 hits. In contrast, the lack of significance awarded to the subject by the medical fraternity is illustrated by the results of a similar search under the term 'pre-ejaculatory fluid' in all the current Health-care databases in the NHS library website, including any field in Medline from 1950 onwards and Embase from 1980, revealed a total of only 15 separate hits (4 were veterinary studies, 2 concerned withdrawal, 1 described condom effectiveness and 8 concerned HIV transmission). Using the term 'pre-cum' resulted in zero hits. This dearth persists despite repeated calls over the last 20 years for more basic research in order to advise condom users informatively (Craig & Hepburn, 1982; Rogow & Horowitz, 1995; Finger, 1996).

One previous study failed to show any sperm in pre-ejaculatory fluid, although this study contained only four normal volunteers (Zuckerman et al., 2003). Two studies have isolated cells containing live HIV virus from pre-ejaculatory fluid, but the cells harbouring the virus appeared to be non-sperm cells. One study by Ilaria et al. (1992) detected no sperm at all in pre-ejaculatory samples from 16 men. In the other by Pudney et al. (1992), 8 out of 23 pre-ejaculatory samples contained 'a few small clumps of spermatozoa'.

The reason why our study was able to demonstrate motile sperm in pre-ejaculatory fluid whereas other studies have failed to do so might lie in the promptness with which we examined the samples. In our IVF unit, the room where men are able to produce their samples is immediately adjacent to the laboratory. We briefed our volunteers appropriately and arranged for an embryologist to be positioned at the microscope awaiting each sample, and we are confident that samples were examined within 2 min of production. After this time, low volume samples can dry out and microscopic examination becomes extremely difficult. No previous publication reports the specific instructions given to men who were asked to collect pre-ejaculatory samples.

Although our pre-ejaculatory samples often contained sperm with equivalent concentration and motility to what would be regarded as fertile in ejaculatory samples, the actual number

of sperm in the pre-ejaculates was very low. We are unable to say how this finding might translate into the chances of pregnancy if these samples of pre-ejaculate were deposited in the vagina except that the chances would not be zero. All but one of our pre-ejaculatory samples contained fewer than 23 million sperm, and values as low as this were seen in ejaculatory samples of less than 2.5% of men whose partners conceived in less than 1 year (Cooper et al., 2010). We did not, however, ask our volunteers to attempt to collect all their pre-ejaculatory secretions but merely to obtain a drop on a Petri dish, and it is possible that some of them emitted more than was collected.

It has been suggested that any sperm in the pre-ejaculatory fluid must be the result of a previous ejaculation and that men who practice withdrawal should pass urine prior to coitus in order to wash away any residual sperm (Withdrawal Method. Planned Parenthood, 2004). However, in all cases in which we observed sperm in pre-ejaculatory fluid the urethra had, of course, been washed with urine on multiple occasions after the last ejaculation, and therefore the contamination of pre-ejaculatory fluid must have taken place immediately prior to ejaculation.

It would appear from our study that some men repeatedly leak sperm in their pre-ejaculatory fluid while others do not.

Although our small population of volunteers were carefully instructed on the need to collect a sample prior to ejaculation it may be that some of them failed to do so and submitted two ejaculatory samples so as to avoid embarrassment. It would have been helpful to have checked the samples that were claimed to be pre-ejaculatory for their fructose and zinc content but this would have been extremely difficult given their small volumes and we did not plan to do so since we did not anticipate this being a problem. Nevertheless, if our aim was to determine whether delaying either condom use or withdrawal (if using *coitus interruptus*) to immediately prior to ejaculation posed a threat for unintended pregnancy then the fact that some men might be unable to judge this moment is enough to answer the question. In other words, sperm may be released prior to ejaculation, or men may be unable to predict the moment of their ejaculation and subsequently fail to admit to this. In either case, this creates a risk of unintended pregnancy from *coitus interruptus* or delayed condom use.

Conclusion

We conclude that a major proportion of men leak motile sperm in their pre-ejaculatory fluid. Current advice should continue to be to wear a condom prior to any genital contact in order to minimise unintended pregnancy and disease transmission.

It is tempting to speculate that the use of withdrawal as a means of contraception might be more successful in some men because they are less likely to release sperm with their pre-ejaculate.

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Figure 1.
Sperm concentration in pre-ejaculatory versus ejaculatory samples.

Table I

Relevant values of semen parameters from WHO guidelines.

Parameter	Normal value
Volume	>2 ml
Concentration	$>20 \times 10^6 \text{ ml}^{-1}$
Motility	>50% moderate or good forward progression
Morphology	15% normal forms
Other cells	$<1 \times 10^6 \text{ ml}^{-1}$

Table II

Analysis of pre-ejaculatory and ejaculatory samples from all 28 volunteers.

Subject number	Abstinence (days)	Volume of pre-ejaculatory sample (ml)	Sperm in pre-ejaculatory sample ($\times 10^6$ ml ⁻¹)	Total sperm seen in pre-ejaculate ($\times 10^6$)	Motility in pre-ejaculatory sperm (%)	Cells in pre-ejaculatory sample ($\times 10^6$ ml ⁻¹)	Sperm in ejaculatory sample ($\times 10^6$ ml ⁻¹)	Motility in ejaculatory sample (%)	Morphology in ejaculatory sample (%)	Cells in ejaculatory sample ($\times 10^6$ ml ⁻¹)
1	1	0.1	0			<1	25	51	20	<1
2	2	0.3	0			<1	25	49	32	<1
3	1	0.1	0			<1	55	65	38	<1
4	1	0.2	0			<1	124	45	20	<1
5	3	0.2	0			<1	60	13	9	<1
6	2	0.5	40	20	50	<1	40	50	25	<1
7	2	0.2	40	8	40	5	35	51	20	<1
8	2	0.2	0			3	51	52	25	<1
9	3	0.1	0			3	59	61	19	<1
10	2	0.5	0			3	48	54	24	<1
16	1	0.1	35	3.5	50	<1	5	60	14	<1
17	2	0.7	50	35	55	<1	50	55	20	<1
18	7	0.1	4	0.4	50	<1	19	48	20	<1
19	3	0.2	0			<1	80	60	20	<1
20	4	0.2	10	2	50	<1	40	60	20	<1
21	1	0.1	2	0.2	50	6	40	50	17	<1
22	1	0.2	2	0.4	0	10	8	50	15	<1
23	1						80	75	20	<1
24	1	0.2	0			4	60	65	20	<1
25	1	0.4	0.5	0.2	60	2	7	60	14	<1
26	1	0.4	0			4	35	60	18	<1
27	2	0.2	0			3	90	60	19	<1
28	1	<0.1	0			<1	30	55	20	<1
14a	5	0.2	0			<1	30	50	19	<1
14b	4	0.2	0			<1	35	45	18	<1

Subject number	Abstinence (days)	Volume of pre-ejaculatory sample (ml)	Sperm in pre-ejaculatory sample ($\times 10^6$ ml ⁻¹)	Total sperm seen in pre-ejaculate ($\times 10^6$)	Motility in pre-ejaculatory sperm (%)	Cells in pre-ejaculatory sample ($\times 10^6$ ml ⁻¹)	Sperm in ejaculatory sample ($\times 10^6$ ml ⁻¹)	Motility in ejaculatory sample (%)	Morphology in ejaculatory sample (%)	Cells in ejaculatory sample ($\times 10^6$ ml ⁻¹)
Mean values for subject 14		0.2	0			<1	32.5	47.5	18.5	<1
13a	6	0.3	10	3.3	25	<1	50	60	20	<1
13b	3	0.2	10	2	20	<1	33	50	19	<1
13c	3	0.2	10	2	30	<1	28	50	19	<1
Mean values for subject 13			10	2.4	25	<1	37	53	19	<1
15a	3	0.1	0			1	46	53	18	<1
15b	3	0.4	0			2	55	50	20	<1
15c	3	0.3	0			1	49	50	20	<1
Mean values for subject 15		0.3	0			2	50	51	19	<1
11a	2	1	20	20	50	1	10	58	19	<1
11b	7	0.5	10	5	40	<1	10	40	15	<1
11c	4	0.2	0.5	1	0	<1	2	30	12	<1
11d	3	0.3	5	2	0	<1	2	50	10	<1
11e	2	0.1	2	0.2	0	<1	3	50	8	<1
Mean values for subject 11		0.4	7.5	5.6	18	<1	5.4	45.6	12.8	<1
12a	>7	0.1	0			<1	54	51	20	<1
12b	5	0.2	0			4	41	50	20	<1
12c	7	0.2	0			<1	54	55	18	<1
12d	7	0.2	0			<1	12	50	17	<1
12e	4	0.1	0			2	30	55	17	<1
Mean values for subject 12		0.2	0			1.8	38.2	52.2	18.4	<1