ORIGINAL ARTICLE

Clinical, behavioural and service-related factors of male reproductive dysfunction in servicemen: a risk index

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Abstract

Aim. To characterise the clinical, andrological, behavioural and service-related profile of reproductive dysfunction in male military personnel, to identify factors independently associated with it, and to propose a simple clinico-andrological risk index (CARI) for referral within military medical services.

Methods. In this retrospective comparative study, records of 180 male servicemen examined at a military hospital in Tashkent, Uzbekistan, in 2023–2025 were analysed: 130 with reproductive dysfunction (main group) and 50 with preserved fertility (comparison group). Categorical semen analysis, hormonal deviations, genitourinary infection, prostatitis, varicocele, behavioural and service factors were compared using χ^2 or Fisher's exact tests and odds ratios (OR). Firth logistic regression adjusted for age and rank (n = 169). The CARI (0–11 points) combined semen category, varicocele, prostatitis, infection, reduced libido and smoking.

Results. Infertility had lasted more than 5 years in 62.3% of the main group, and 81.5% had no children. Azoospermia was found in 16.3%. Genitourinary infection (67.5% vs. 2.0%), prostatitis (71.5% vs. 4.0%), varicocele (74.6% vs. 10.0%) and smoking (58.5% vs. 12.0%) were more frequent in the main group (all $p < 0.001$). After adjustment, infection (adjusted OR 21.37; 95% CI 2.71–168.60), deployments longer than one month (71.92; 3.84–1345.62) and reduced libido (30.35; 1.99–461.71) remained associated with reproductive dysfunction; varicocele was borderline (5.05; 0.95–26.69; $p = 0.057$). The median CARI was 8 [7; 10] vs. 0 [0; 0], and a high risk level was found in 83.6% vs. 2.0% ($p < 0.001$).

Conclusion. Reproductive dysfunction in servicemen is multifactorial and long-standing at presentation. Infectious-inflammatory and service-related factors are potentially correctable targets. The CARI may support triage and follow-up at 3 and 6 months but requires prospective calibration and external validation.

Keywords: *Infertility, Male; Military Personnel; Prostatitis; Risk Assessment; Semen Analysis; Varicocele.*

MAIN TEXT

Introduction

Infertility, defined as failure to achieve a clinical pregnancy after 12 months or more of regular unprotected intercourse, affects about one in six people worldwide; the World Health Organization (WHO) estimates its lifetime prevalence at 17.5%. Estimates vary considerably with the definition and method of estimation [1], but a male factor contributes to roughly half of infertile couples [2]. Concern about male reproductive health has been reinforced by evidence of a continuing global decline in sperm concentration [3, 4].

Current European Association of Urology (EAU) and American Urological Association/American Society for Reproductive Medicine (AUA/ASRM) guidelines recommend that the male partner undergo a structured urological evaluation combining reproductive history, physical examination, semen analysis performed to WHO standards, endocrine assessment and, where indicated, imaging and genetic testing [5–7]. The guidelines also emphasise that a single semen analysis cannot reliably separate fertile from subfertile men, and that modifiable factors such as varicocele, genital tract infection and inflammation, tobacco and alcohol use, and psychological stress should be identified and addressed [5, 6, 8–12].

Military personnel are a distinctive population in this respect. Most service members are in their peak reproductive years, yet they are exposed to sustained physical load, irregular sleep, prolonged deployments away from their partners, occupational hazards and psychological stress, while service duties may delay access to specialised andrological care. Recent studies from the United States Military Health System found that tobacco use was associated with an abnormal total motile sperm count [13], but found no difference in semen parameters between occupational groups [14]; a survey of 480 infertile Chinese servicemen documented high anxiety levels that worsened fertility-related quality of life. Evidence from Central Asia is lacking, and, to our knowledge, no study has combined andrological, infectious-inflammatory, behavioural and service-related factors into a practical tool for referral within military medical services [15, 16].

The aims of this study were (1) to describe the clinical-anamnestic, andrological, hormonal, behavioural and service-related profile of servicemen with reproductive dysfunction in comparison with fertile servicemen; (2) to estimate the associations of these factors with reproductive dysfunction after adjustment for age and rank; and (3) to construct a simple clinico-andrological risk index and a follow-up algorithm for military medical services.

Material and Methods

Study design and setting

This retrospective comparative study is reported according to the STROBE statement [17]. Medical records generated between 2023 and 2025 at the urology department of the Central

Military Clinical Hospital of the Ministry of Defence of the Republic of Uzbekistan, Tashkent were analysed. All participants were male servicemen under a single departmental system of medical supervision, which reduced organisational heterogeneity.

Participants

The source database contained 181 records; one empty record was excluded, leaving 180 servicemen for analysis. The main group comprised 130 men of reproductive age with clinically established reproductive dysfunction in marriage or andrological findings requiring evaluation and a completed clinical-anamnestic data block. The comparison group comprised 50 servicemen without signs of infertility, with a recorded pregnancy in marriage or existing children, and with sufficient data for comparison. Records with incomplete age data, records that did not allow reliable allocation to a group, and records without identifying codes in the de-identified database were excluded. The 130:50 ratio reflects the study design and was not used to estimate prevalence. Sample size was determined by the available records; no a priori power calculation was performed, so the precision of estimates is expressed by 95% confidence intervals (CI).

Variables and measurements

Data were collected with a standardised observation card containing 35 variables in seven blocks: demographic and service characteristics; reproductive history; semen and hormones; andrological and somatic history; behavioural and service factors; functional and psychoemotional status; and derived indices. Age was grouped as 20–25, 26–30, 31–35, 36–40 and 41–45 years; rank as officers or sergeants; and length of service as 1–5, 5–10 or more than 10 years. Duration of infertility, childlessness, previous pregnancy in marriage and repeat marriage were recorded.

Semen analysis followed the WHO laboratory manual. Because the primary database stored semen results as categories rather than continuous values, ejaculates were classified as azoospermia or by the proportion of motile spermatozoa (10–20%, 20–40%, 40–60%, 60–80% or more than 80%); concentration values were not reconstructed. Deviations of testosterone, prolactin, follicle-stimulating hormone (FSH), luteinising hormone (LH) and oestradiol from laboratory reference ranges were recorded as binary variables. Genitourinary infection (a laboratory-confirmed infectious process), prostatitis (a clinical andrological diagnosis) and varicocele (clinical and ultrasound diagnosis) were recorded as separate variables. Behavioural and service factors included smoking, alcohol use, heavy physical load, deployments longer than one month, harmful service conditions and nutritional disorders. Reduced or absent libido, stress or nervousness, and difficulties in family relationships during the previous six months were also recorded.

Missing values were not treated as absence of a feature. Records with contradictory entries were excluded only from the analysis of the affected variable, so variable-specific denominators

were used (main group: semen analysis n = 129, infection n = 123, libido n = 129, deployments n = 127, harmful conditions n = 123, nutrition n = 128, family relationships n = 125, psychoemotional status n = 126). Data completeness ranged from 94.6% to 99.2%.

Clinico-andrological risk index

The CARI was designed as a primary triage tool using six components that are available at the first consultation: semen category (azoospermia or motility below 40%, 3 points; 40–60%, 2 points; 60–80%, 1 point), varicocele, prostatitis and genitourinary infection (2 points each), and reduced libido and smoking (1 point each), giving a total of 0–11 points. Working cut-offs defined low (0–2), moderate (3–5) and high (6–11) risk. Weights were assigned by expert clinical rule according to proximity to the reproductive outcome and urgency of investigation, not by rounding regression coefficients. The index was calculated only when all six components were available (main group n = 122; comparison group n = 50). Deployments, stress and harmful conditions were analysed separately as organisational modifiers and were not added to the score.

Statistical analysis

Categorical variables are presented as counts and percentages and were compared using Pearson's χ^2 test or Fisher's exact test when expected frequencies were small; for multi-category variables the whole contingency table was tested. ORs with 95% CI were calculated from 2×2 tables; when a cell contained zero, 0.5 was added to every cell for OR estimation only, while exact p values were computed from the original frequencies. Because several factors were absent in the comparison group (quasi-complete separation), Firth penalised logistic regression [18] was used to estimate adjusted ORs (aOR). The model included age, rank, genitourinary infection, smoking, varicocele, prostatitis, reduced libido and deployments longer than one month and was fitted on 169 complete observations (119 main, 50 comparison). Quantitative indices are presented as mean ± standard error (M ± m) and median [Q1; Q3]. Univariable comparisons were exploratory and were not corrected for multiplicity. A two-sided $p < 0.05$ was considered significant.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki [19]. Personal data were coded before statistical analysis. The study used anonymised retrospective medical records: personal identifiers, case-history numbers and names were removed before analysis, and sensitive data on sexual function and family relationships were used only in aggregated form. Only men were included because the research question concerns male reproductive function; "sex" refers to biological sex.

Results

Participant characteristics and reproductive history

The age distribution did not differ between groups ($\chi^2 = 7.52$; $p = 0.111$); men aged 31–35 years formed the largest subgroup of the main group (36.2%). Rank differed significantly: sergeants accounted for 83.1% of the main group and 40.0% of the comparison group ($\chi^2 = 30.56$; $p < 0.001$), whereas length of service was similar ($p = 0.652$) (Table 1). Infertility had lasted more than 5 years in 62.3% of the main group, 81.5% had no children, and 18.5% reported a previous pregnancy in marriage, indicating secondary reproductive dysfunction. Repeat marriage was recorded in 15.0% of the main group and in none of the comparison group ($p = 0.002$).

Table 1. Demographic, service and reproductive characteristics of the study groups.

Characteristic	Main group (n = 130), n (%)	Comparison group (n = 50), n (%)	p
Age, years			0.111[a]
20–25	5 (3.8)	4 (8.0)	
26–30	36 (27.7)	8 (16.0)	
31–35	47 (36.2)	13 (26.0)	
36–40	30 (23.1)	17 (34.0)	
41–45	12 (9.2)	8 (16.0)	
Rank			<0.001[a]
Officers	22 (16.9)	30 (60.0)	
Sergeants	108 (83.1)	20 (40.0)	
Length of service			0.652[a]
1–5 years	19 (14.6)	7 (14.0)	
5–10 years	53 (40.8)	17 (34.0)	
>10 years	58 (44.6)	26 (52.0)	
Duration of infertility		—	—
1–2 years	10 (7.7)		
3–5 years	39 (30.0)		
6–10 years	51 (39.2)		
>10 years	30 (23.1)		
Repeat marriage[c]	19 (15.0)	0 (0.0)	0.002[b]
No children	106 (81.5)	0 (0.0)	<0.001[b]
Previous pregnancy in marriage	24 (18.5)	50 (100.0)	<0.001[b]

[a] Pearson's χ^2 test (whole contingency table); [b] Fisher's exact test; [c] denominator n = 127 (marital status available). Duration of infertility was not compared because the comparison group was defined by preserved fertility.

Semen analysis and hormonal profile

Semen category was assessed in 129 men of the main group. Azoospermia was found in 16.3%, motility of 10–40% in 31.0%, 40–60% in 36.4%, 60–80% in 14.7% and more than 80% in 1.6%, whereas 88.0% of the comparison group had motility above 80% ($\chi^2 = 146.84$; $p < 0.001$) (Figure 1). Prolactin deviations were recorded in 19.2% of the main group ($p < 0.001$), FSH and LH deviations in 9.2% each ($p = 0.039$ for both), oestradiol deviations in 2.3% ($p = 0.561$) and testosterone deviations in 1.5% ($p = 1.000$); none were found in the comparison group.

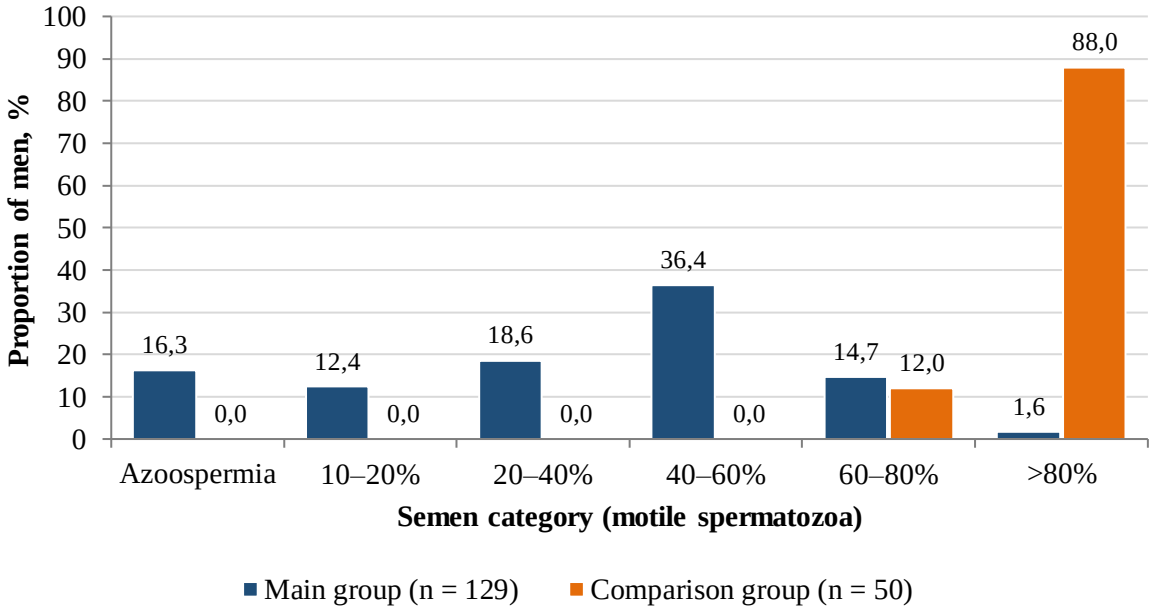


Figure 1. Distribution of semen categories (azoospermia or proportion of motile spermatozoa) in the main group (n = 129) and the comparison group (n = 50); $\chi^2 = 146.84$, $p < 0.001$.

Infectious-inflammatory, vascular, behavioural and service factors

Genitourinary infection, prostatitis and varicocele were the most frequent findings in the main group and showed the strongest univariable associations (Table 2). A history of testicular trauma was more frequent in the main group (8.5% vs. 0%; $p = 0.036$), whereas cryptorchidism (7.7%; $p = 0.064$) and mumps (5.4%; $p = 0.193$) did not differ significantly. Smoking (58.5% vs. 12.0%), alcohol use (19.2% vs. 0%), deployments longer than one month (49.6% vs. 0%), harmful service conditions (26.8% vs. 0%) and nutritional disorders (17.2% vs. 0%) were all more frequent in the main group ($p < 0.001$), whereas heavy physical load was rare in both groups (3.1% vs. 0%; $p = 0.577$). Reduced or absent libido (64.3%), stress or nervousness (30.2%) and difficulties in family relationships (16.0%; $p = 0.001$) were recorded only in the main group (Figure 2).

Table 2. Univariable comparison of andrological, hormonal, infectious-inflammatory, behavioural and service factors.

Factor	Main group, n (%)	Comparison group (n = 50), n (%)	OR (95% CI)	p
Genitourinary infection[a]	83 (67.5)	1 (2.0)	101.68 (13.55–763.03)	<0.001
Prostatitis	93 (71.5)	2 (4.0)	60.32 (13.94–261.03)	<0.001
Varicocele	97 (74.6)	5 (10.0)	26.45 (9.69–72.26)	<0.001
Testicular trauma	11 (8.5)	0 (0.0)	—	0.036
Cryptorchidism (history)	10 (7.7)	0 (0.0)	—	0.064
Mumps (history)	7 (5.4)	0 (0.0)	—	0.193
Prolactin deviation	25 (19.2)	0 (0.0)	—	<0.001
FSH deviation	12 (9.2)	0 (0.0)	—	0.039
LH deviation	12 (9.2)	0 (0.0)	—	0.039
Smoking	76 (58.5)	6 (12.0)	—	<0.001
Alcohol use	25 (19.2)	0 (0.0)	—	<0.001
Deployments >1 month[a]	63 (49.6)	0 (0.0)	—	<0.001
Harmful service conditions[a]	33 (26.8)	0 (0.0)	—	<0.001
Nutritional disorder[a]	22 (17.2)	0 (0.0)	—	<0.001
Reduced or absent libido[a]	83 (64.3)	0 (0.0)	—	<0.001
Stress or nervousness[a]	38 (30.2)	0 (0.0)	—	<0.001
Family relationship difficulties[a]	20 (16.0)	0 (0.0)	—	0.001

p values from Fisher's exact test. OR = odds ratio; CI = confidence interval; FSH = follicle-stimulating hormone; LH = luteinising hormone; "—" = not reported in the source analysis. [a] Variable-specific denominators in the main group (infection 123; deployments 127; harmful conditions 123; nutrition 128; libido 129; psychoemotional status 126; family relationships 125).

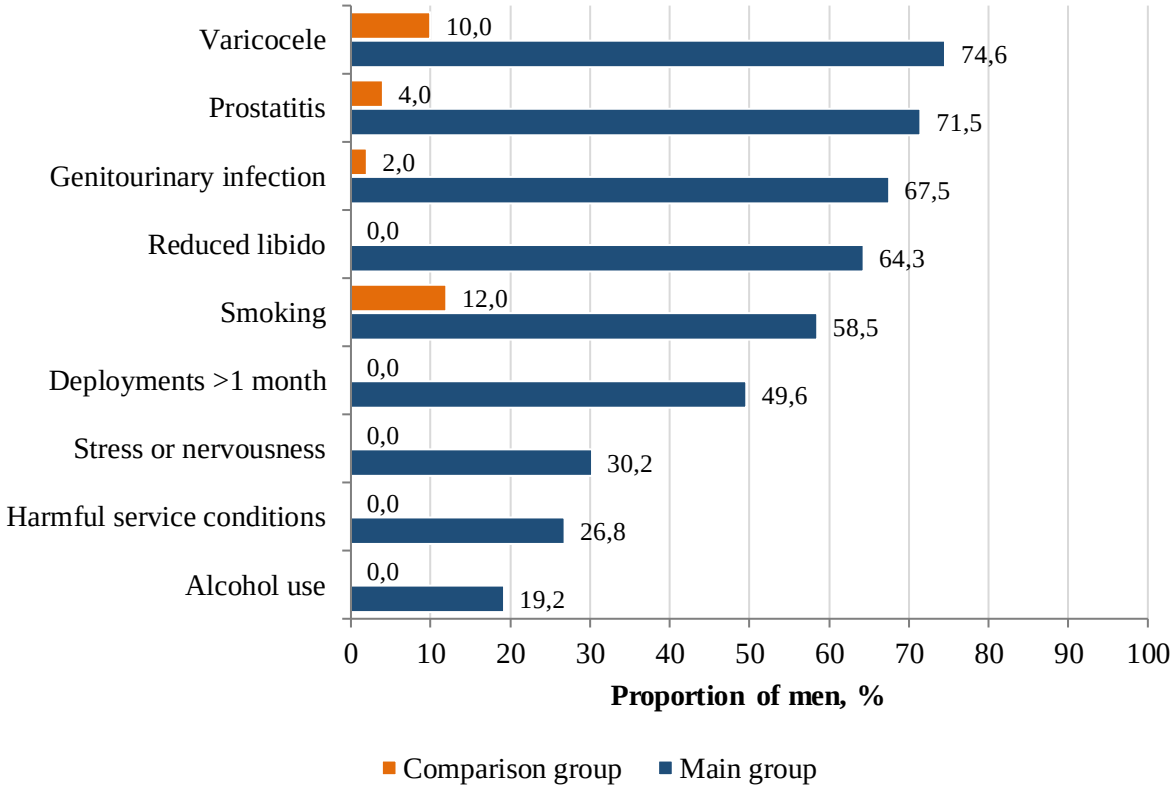


Figure 2. Frequency of the leading clinical, behavioural and service-related factors in the main and comparison groups (percentages calculated on variable-specific denominators; all $p \leq 0.001$).

Factor burden and adjusted associations

The mean number of leading andrological factors (of three) was 2.16 ± 0.09 in the main group and 0.16 ± 0.06 in the comparison group; the mean number of modifiable and service factors (of five) was 1.88 ± 0.11 and 0.12 ± 0.05; and the total clinical risk burden (of nine) was 4.69 ± 0.18 and 0.28 ± 0.10, respectively (all $p < 0.001$). In the Firth model, genitourinary infection, deployments longer than one month and reduced libido remained associated with reproductive dysfunction, varicocele showed a borderline association, and the associations of prostatitis and smoking were no longer significant (Table 3). The confidence intervals were wide, reflecting the small comparison group and zero cells.

Table 3. Adjusted associations with reproductive dysfunction (Firth logistic regression; n = 169).

Factor	Main group, n (%)	Comparison group, n (%)	aOR (95% CI)	p
Genitourinary infection	83 (67.5)	1 (2.0)	21.37 (2.71–168.60)	0.004
Deployments >1 month	63 (49.6)	0 (0.0)	71.92 (3.84–1345.62)	0.004
Reduced libido	83 (64.3)	0 (0.0)	30.35 (1.99–461.71)	0.014
Varicocele	97 (74.6)	5 (10.0)	5.05 (0.95–26.69)	0.057
Prostatitis	93 (71.5)	2 (4.0)	1.86 (0.17–20.88)	0.613
Smoking	76 (58.5)	6 (12.0)	1.02 (0.16–6.40)	0.983

aOR = adjusted odds ratio, mutually adjusted for the listed factors and for age and rank (age and rank retained as covariates; their coefficients are not shown). Complete-case analysis: 119 main and 50 comparison observations.

Clinico-andrological risk index

The CARI was calculated for 122 men of the main group and all 50 men of the comparison group (Table 4). The mean score was 7.82 ± 0.23 vs. 0.56 ± 0.19, the median 8 [7; 10] vs. 0 [0; 0], and the range 1–11 vs. 0–6. A high risk level (6–11 points) was found in 83.6% of the main group and 2.0% of the comparison group, and a low level (0–2 points) in 7.4% and 86.0%, respectively (χ^2 = 112.27; p < 0.001) (Figure 3). Applying the index, a repeat semen analysis was indicated in 98.4% of the main group, investigation for genitourinary infection in 83.7%, scrotal ultrasound with varicocele assessment in 84.5%, hormonal testing in 72.7%, medical genetic counselling in 28.7% and a smoking cessation programme in 58.5%.

Table 4. Components of the clinico-andrological risk index (CARI) and their frequency.

Component	Points	Main group, n (%)	Comparison group (n = 50), n (%)	p
Azoospermia or motility <40%	3	61 (47.3)	0 (0.0)	<0.001
Motility 40–60%	2	47 (36.4)	0 (0.0)	<0.001
Motility 60–80%	1	19 (14.7)	6 (12.0)	0.811
Varicocele	2	97 (74.6)	5 (10.0)	<0.001
Prostatitis	2	93 (71.5)	2 (4.0)	<0.001
Genitourinary infection	2	83 (67.5)	1 (2.0)	<0.001
Reduced libido	1	83 (64.3)	0 (0.0)	<0.001
Smoking	1	76 (58.5)	6 (12.0)	<0.001
Total score (range)	*0–11*			

Risk levels: low 0–2, moderate 3–5, high 6–11 points. The index was calculated only when all six components were available (main group n = 122). p values from Fisher's exact test.

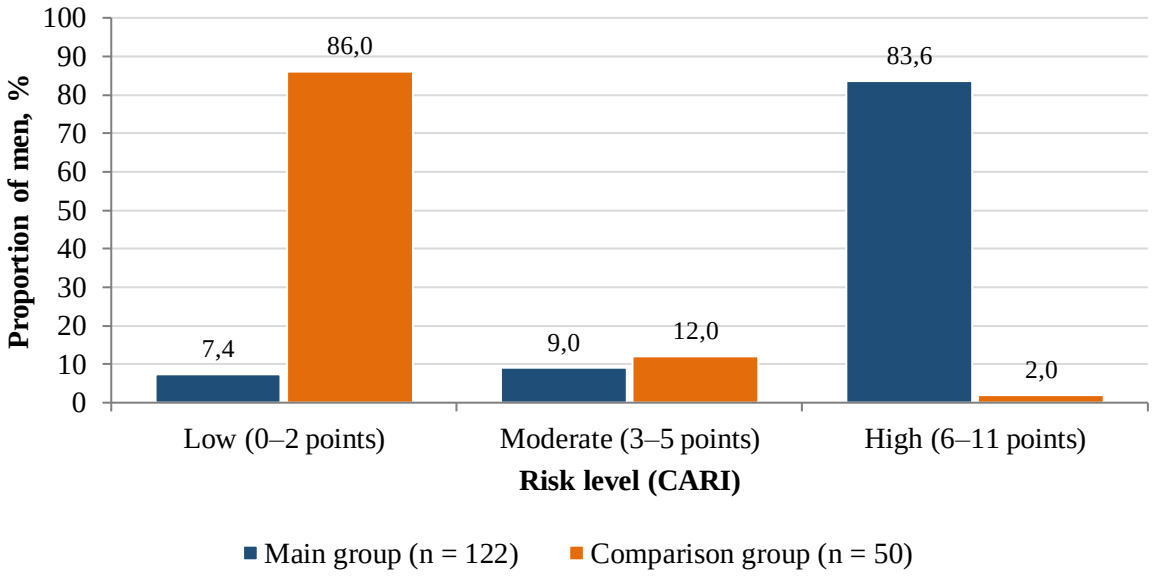


Figure 3. Distribution of clinical risk levels according to the clinico-andrological risk index in the main group (n = 122) and the comparison group (n = 50); $\chi^2 = 112.27$, $p < 0.001$.

Proposed referral and follow-up algorithm

On the basis of these findings, a stepwise algorithm was proposed. Men with low risk receive scheduled follow-up, counselling and repeat testing if complaints persist. Men with moderate risk receive treatment of the inflammatory factor, smoking cessation, reduction of overheating and regimen violations, planned control visits around deployments and reassessment after 3 months. Men with high risk receive expedited aetiological investigation and specialist care, with documented control points at 3 and 6–12 months (semen analysis, completion of treatment, factor burden, referral outcome and retention in follow-up). Irrespective of the score, azoospermia, suspected obstruction, cryptorchidism, testicular trauma, markedly reduced testicular volume or signs of severe endocrine disease trigger accelerated urological-andrological, ultrasound, hormonal and, where indicated, genetic investigation.

Discussion

This study shows that reproductive dysfunction in servicemen presents late and is multifactorial. Nearly two-thirds of affected men had been infertile for more than 5 years and four in five were childless. Varicocele, prostatitis and genitourinary infection each affected about 70% of the main group. After adjustment, genitourinary infection, long deployments and reduced libido remained independently associated with reproductive dysfunction. A six-component risk index clearly separated affected and fertile servicemen and translated these findings into a referral pathway [20].

The long duration of infertility before evaluation suggests delayed help-seeking or delayed referral, which is plausible in a population whose duties, rotations and deployments compete with

health care. Guo et al. likewise found that years of infertility and anxiety shaped fertility-related quality of life in infertile servicemen. Because female age and ovarian reserve decline over the same years, delay reduces the couple's overall chance of conception; this supports the guideline recommendation that both partners be evaluated early and in parallel [5, 7].

The frequency of varicocele in the main group (74.6%) is far above the roughly 15% reported in the general male population and the approximately 35% reported in men with primary infertility [8]. In a study of 7035 young European men, varicocele was associated with impaired semen quality and altered reproductive hormones, particularly in higher grades [21]. In our model, the association of varicocele was attenuated to a borderline aOR of 5.05, probably because of overlap with infectious-inflammatory factors and the small comparison group rather than an absence of effect. Given meta-analytic evidence that varicocele repair improves semen parameters and pregnancy rates in selected infertile men [22], scrotal examination and ultrasound in the standing position and with the Valsalva manoeuvre should remain part of the routine assessment of servicemen, as recommended by European andrology guidelines [23, 24].

Genitourinary infection was the most robust independent factor (aOR 21.37). Male accessory gland infection and inflammation impair sperm function through leukocyte-derived oxidative stress, obstruction and immune mechanisms, and are recognised by the EAU as potentially treatable causes of male infertility [2, 5]. Prostatitis lost significance after adjustment, most likely because it overlaps clinically with documented infection; the two variables should therefore be interpreted together as one inflammatory domain. In practice, these are the most accessible targets for military medical services because diagnosis and treatment are available at the garrison or hospital level [25–27].

Smoking was strongly associated with reproductive dysfunction in the univariable analysis but not after adjustment. This pattern is compatible with confounding by rank and by clustering of risk behaviours; it does not mean that smoking is harmless. A meta-analysis including more than 5,000 men showed that cigarette smoking reduces sperm count and motility [9], and a recent study in the United States Military Health System found that tobacco use was associated with an almost two-fold higher risk of an abnormal total motile sperm count [13]. Alcohol use was reported only by men in the main group; heavy alcohol intake has likewise been linked to lower semen volume and abnormal morphology [10]. Both behaviours remain appropriate targets for counselling.

Deployments longer than one month had the largest but least precise adjusted OR (71.92; 95% CI 3.84–1345.62). The width of this interval reflects quasi-complete separation, because no man in the comparison group reported such deployments, and the estimate should not be read as a biological effect size. Long deployments may act mainly through reduced frequency of intercourse during the fertile window, delayed investigation and interrupted treatment, as well as through stress

and occupational exposures. Gregg et al. found no difference in semen parameters between military occupational groups [14], which supports an organisational rather than a gonadotoxic interpretation. For this reason, deployments were treated as a modifier of follow-up rather than as a component of the score. Planning semen analyses and control visits around deployments is a simple, low-cost response.

Reduced libido (64.3%) was independently associated with reproductive dysfunction. It may reflect psychological stress, relationship strain, hormonal deviations (prolactin deviations were present in 19.2%) or the psychological burden of infertility itself. Psychological stress is known to impair semen quality through the hypothalamic–pituitary–gonadal axis and oxidative mechanisms [11]. Because the direction of this association cannot be established in a retrospective design, sexual function and psychological status should be assessed together with andrological findings, and confidential psychological support should be offered.

The CARI is intended as a triage tool, not a diagnostic test. It uses information available at the first visit, does not require an extended laboratory panel and links each risk level to a defined set of actions and control points. The near-complete separation of the groups (83.6% vs. 2.0% at high risk) is expected in a design that compares clinically affected men with men of proven fertility, and it would overstate discrimination in an unselected population. We therefore did not report discrimination statistics and regard the cut-offs as provisional. The index has been introduced in two regional military hospitals, but its calibration, reliability and effect on time to diagnosis must be tested prospectively in unselected servicemen before wider use. Meanwhile, repeating an abnormal semen analysis after standardised abstinence and avoiding testing immediately after fever, night duty or extreme exertion is consistent with WHO recommendations.

Strengths and limitations

The strengths of this study include the simultaneous assessment of andrological, infectious-inflammatory, hormonal, behavioural and service domains in a defined military population; transparent handling of missing and contradictory data with variable-specific denominators; and the use of penalised regression appropriate for sparse data. Its limitations are substantial. The design was retrospective and single-centre. Semen results were categorical, without concentration or morphology. The comparison group was small and selected on proven fertility, which inflates odds ratios (spectrum bias). Groups differed by rank. Behavioural and psychological data were recorded from medical documentation rather than validated questionnaires. Female partner factors were not available. Multiple univariable tests were not corrected. Finally, the CARI weights were assigned by expert rule and have not been validated. All results should be interpreted as associations, not causal effects.

Conclusion

Reproductive dysfunction in servicemen is long-standing at presentation and multifactorial. Varicocele, genitourinary infection and prostatitis form its leading clinical core, while smoking, alcohol, long deployments, harmful service conditions and reduced libido modify risk and the feasibility of follow-up. Genitourinary infection, long deployments and reduced libido remained associated with reproductive dysfunction after adjustment. A simple six-component clinico-andrological risk index, linked to defined actions and control points at 3 and 6 months, may help military medical services prioritise investigation and treatment, pending prospective validation.

Additional information

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Conflict of interest. The authors declare no conflict of interest.

Ethical approval. The study was conducted in accordance with the Declaration of Helsinki. Personal data were coded before statistical analysis.

Consent. The study was based on anonymised retrospective medical records; no identifiable personal data were collected or published.

Author contributions. All authors contributed to the compilation and layout of this material.

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Data availability. The data are available from the corresponding author upon reasonable request and subject to approval by the Ministry of Defence of the Republic of Uzbekistan because they originate from military medical records.

Generative artificial intelligence. During the preparation of this work the authors used Claude (Anthropic, https://claude.ai) in order to translate the dissertation material into English and to structure and edit the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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