Scrotal Hematoma Precipitated by Centrifuge Training in a Fighter Pilot with an Asymptomatic Varicocele

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BACKGROUND: Varicocele is quite common in the general population, affecting up to 15% of men. It is not considered disqualifying for the pilot's training program of the Israeli Air Force as long as there are no related symptoms or associated pathologies. During combat flight, increased venous pressure due to acceleration forces and anti-G straining maneuvers, used to counteract high gravitational G forces, can theoretically aggravate the venous blood pooling in varicocele, leading to rupture.

CASE REPORT: We describe a case of a young fighter-jet pilot presenting with a painful inguinal hematoma extending to the scrotum a day after participating in centrifuge training. Sonographic examination demonstrated dilated spermatic veins and intratesticular varicocele along with subcutaneous thickening of the scrotal wall consistent with hematoma.

DISCUSSION: The effects of high G loads on blood flow in spermatic veins, and especially in varicocele, still need to be determined. Varicocele rupture has been described in relation to increased intra-abdominal pressure and could theoretically occur during anti-G straining maneuvers. Such an acute adverse event during combat flight can be detrimental to flight safety and the pilot's well-being.

KEYWORDS: varicose spermatic veins, high-performance aircraft, acceleration, G forces.

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Varicocele, defined as abnormally dilated veins in the pampiniform venous plexus in the scrotum, is diagnosed only in humans and seems to be associated with the erect position. Incompetence of internal spermatic vein valves increases intravascular pressure above the physiological level in the venous drainage, causing deviation of testicular venous flow and leading to varicocele evolvement.[10] Reviewing the literature, it is still unknown whether the unique flight conditions encountered by aircrews, such as acceleration forces, aggravate the natural history of varicocele. Kousoulis and colleagues[6] reported the incidence of varicocele in fighter pilots during training is not different from that observed in similarly aged populations.

Centrifuge training is employed to raise high G load tolerance by practicing performance of optimally effective anti-G straining maneuvers.[4] Performance of these maneuvers, either in flight or simulated in a centrifuge, causes increased intrathoracic pressure in aircrew.[2,8] Our hypothesis is that intravascular pressure in renal veins, which drain the spermatic veins, is increased during anti-G straining maneuvers, leading to retrograde flow of venous blood toward the testes. To our knowledge, the effect of acceleration and high G loads on blood flow in the gonadal veins has not been studied before, and no adverse outcomes have been reported in pilots of high-performance aircraft diagnosed with varicocele.

CASE REPORT

A 23-yr-old military fighter-jet pilot presented with orchalgia and inguinal hematoma, which was noted the day after participating in centrifuge training. The trainee had complained of an increasing pain in the scrotum, which radiated to the left thigh and abdomen. He reported a previously known left-sided varicocele, but denied any symptoms beforehand. His physical examination revealed a well palpable fluctuant structure in the

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upper left scrotum, with no pulsation, and a 5 × 5 cm hematoma in the left inguinal region.

He was referred urgently to an urologist in a nearby tertiary medical center. A left-sided grade III varicocele was sonographically confirmed. Acute testicular complications, such as torsion or intratesticular bleed, were excluded. Cooling and elevation of the scrotum were recommended, and he was instructed to immediately return to consult a medical authority in case of worsening or persistent complaints.

When presenting to the Israeli Air Force Medical Center 72 h after the training, the pain had diminished. On physical examination an extended hematoma was then noted on the anterior aspect of the scrotum (8 × 5 cm). Testes were of normal size and consistency, with no masses palpated or fluctuation, except for a tender vascular structure at the proximal left scrotum, consistent with high-grade varicocele, as previously recorded in his medical file. Cremasteric reflex was preserved bilaterally.

When asked about the course of events, our patient did not recall any acute testicular or groin pain during the centrifuge training, but had reported a slight inconvenience in his groin area and bilateral thigh muscle ache right after the simulation (symptoms reported by other trainees as well). He had noticed the inguinal and scrotal hematoma only the day after the training, in association with increasing left inguinal pain, as previously described.

Repeated scrotal ultrasonography at that point revealed testes of normal size and consistency. Diffuse marked thickening of the scrotum was noted, with a maximal width of 0.6 mm, consistent with hematoma (**Fig. 1A** and **Fig. 1B**). Doppler examination showed normal testicular arterial blood flow. Dilated spermatic veins, up to 4.4 mm in width, were demonstrated on the left side, as well as intratesticular varicocele (**Fig. 1C** and **Fig. 1D**). He was advised to repeat sonographic examination and return for further inspection within 4 wk.

In this case, imaging studies could not confirm the theory that the inguinal and following scrotal hematoma originated from the varicocele. No disruption of blood flow in the spermatic veins, or defects in continuity of the pampiniform venous plexus, were demonstrated on Doppler ultrasonography. After ruling out our hypothesis of association between the appearance of the hematoma right after the centrifuge training and the pre-existing varicocele, it was decided to allow the young aviator to return to flying duties with no restrictions.

DISCUSSION

Hematoma of the scrotum or spermatic cord has been described in association with ruptured varicocele.[1,5,7] It was postulated in these reports that the high venous pressure, generated during straining (e.g., Valsalva maneuver, defecation), could have caused acute scrotal venous hemorrhage. Varicocele rupture may also occur due to blunt abdominal trauma with a sudden increase in intra-abdominal pressure transmitting to the varicocele.[5] Nevertheless, we believe the appropriate explanation for the evolvement of a scrotal hematoma in this case is subcutaneous bleed as a result of local vasculature injury rather than varicocele rupture resulting from intravascular pressure changes.

Performing repeated anti-G straining maneuvers to counteract acceleration forces requires intense abdominal wall muscle usage. Abdominal muscles also contract to counteract external pressure during anti-G suit inflation.[9] As a result, pilots often complain of abdominal pain after high G stress. It was demonstrated that the abdominal muscles (rectus abdominis and vastus muscles) are not completely

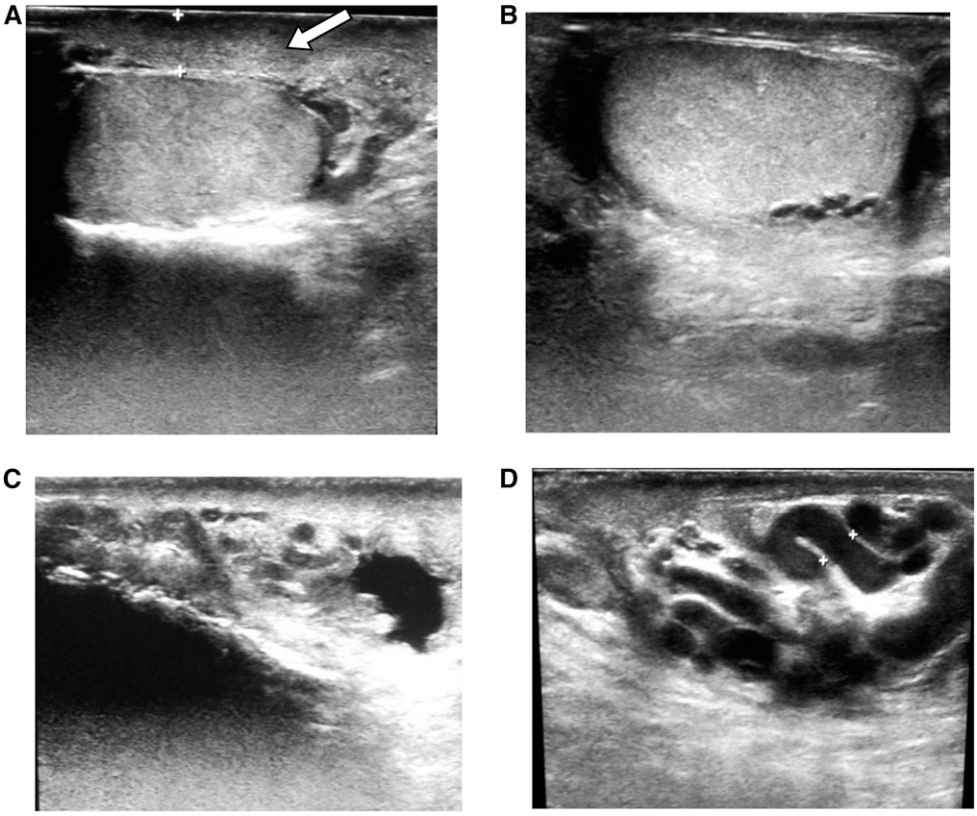

Fig. 1. Sonographic examination of testes and scrotum 72 h after the centrifuge training. A) Right testicle. Arrow points to mild scrotal wall thickening (0.6 cm) compatible with hematoma. B) Left testicle. Normal appearing scrotal wall thickness; also shows an intratesticular varicocele. C) Right scrotum. Multiple, dilated, and tortuous veins are seen, compatible with right-sided varicocele. D) Left scrotum. Multiple, dilated, and tortuous veins are seen, more prominent than in A, compatible with a left-sided varicocele.

relaxed even without performing active straining maneuvers due to pressure applied from the abdominal bladder of the anti-G suit.[3] Another observation that can support our proposed explanation is that petechial hemorrhages over the arms, mid torso, and legs are commonly observed in trainees after exposure to high G stress on the centrifuge.[4] The scrotal hemorrhage in the case presented may be considered as such cutaneous petechia.

This case report documents a pilot known to have an asymptomatic pre-existing varicocele presenting with scrotal/inguinal hematoma following centrifuge training. Though there are several reports of varicocele hemorrhage due to sudden increase of intra-abdominal pressure,[1,5,7] to the best of our knowledge, it has never been described in relation to anti-G straining maneuvers in combat flight. The significance of this for the health of the pilot, the safety of flight, or combat capability is unknown. A better understanding of the effects of acceleration forces upon dilated spermatic veins might help answer these questions.

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