Military nephrology—what a civilian doctor should know

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Abstract

This article provides some background on military nephrology in the UK. The primary objective of the Defence Medical Services is the maintenance of operational capability of military personnel. This includes exclusion of nephrological diseases that might reduce renal reserve to a critical level under field conditions, increasing susceptibility to trauma, burns, infection and adverse environmental conditions and increasing the need for renal support. Renal failure potentially compromises not only the patient but also his comrades through reduced staffing and inability to execute the military mission. Safety of weapon systems for which the patient is responsible may be reduced. At forward locations, need for evacuation may put aircraft or vehicles and their crew with medical attendants at unnecessary risk. Regular follow-up and continuity of care are difficult owing to the demands of military life that include frequent postings and deployments.

Keywords: applicant assessment; military hazards; military nephrology; trauma

Introduction to the military situation

It may seem obvious to state that working in the armed forces is a potentially dangerous occupation but this danger exists before enemy forces are ever encountered (see Box 1). A convenient civilian comparison would be with a building site. Novel pathogens may cause severe debilitating illness in otherwise fit military personnel and these may be specific to theatres of operation. For example, hantavirus infection with features of disseminated intravascular coagulation and acute kidney injury secondary to interstitial nephritis was problematic in some sectors in Bosnia [1].

These considerations require exceptionally fit personnel whose physiological reserve in all body systems is at least equal to the operational challenge related to deployment. In addition, there is the desire that personnel should be capable of surviving serious injury where the physiological challenge will be extraordinary (See Figure 1) and the risk to renal function will be commensurately greater. A study of estimate of glomerular filtration rate (eGFR) of severely injured military personnel on arrival at the field hospital having received pre-hospital care will be reported later in the article. An interim analysis of the first 35 cases reveals values varying between 53 and 144 mL/min/1.73m² with a median of 82 mL/min/1.73m². There may be untested genetic factors that limit adequate response to the novel encounters on deployment. Examples may be the inability to control serum sodium concentration [2] and neurological susceptibility to this and to elevated core temperature [3]. Assessments of susceptibility to heat stress by testing for mutations in a candidate gene [e.g. ryanodine receptor (RyR1)] unfortunately carry a false-positive rate in excess of 20% [4].

With excellent treatment, there is the expectation that, wherever possible, eventual return to operational duties will be achieved. Failure to identify those members of the armed forces with significant physiological compromise in one or more systems may not only put their lives at risk but also the lives of those who will have to extract them from locations which are both environmentally and militarily hostile. It is a mistake to assume that certain military occupations will not be expected to contribute to hostile activities. Each and every member of the armed forces is expected to achieve gender- and age-related fitness levels and, apart from ministers of religion, a level of skill at arms
appropriate for their military specialty. This is the basic ability that distinguishes military from civilian personnel. There are no exceptions.

Renal assessment of an applicant for military service

A history of antecedent renal disease will be sought (See also Box 2). Steroid-resistant nephrotic syndrome in child-

hood will result in referral for nephrological review and decisions made on an individual basis. Absence of relapse in excess of 5 years in cases where renal biopsy showed a benign lesion (i.e. minimal changes or mild mesangial proliferation) may be acceptable. The medical examination includes measurement of blood pressure and examination of the urine produced at the time of examination by dipstick. Hypertension will result in the rejection of an applicant. In cases where blood pressure is borderline, 24-h ambulatory blood pressure recording will be required. The presence of persistent urinary abnormalities (blood, protein or both or leucocytes) under circumstances where strenuous physical exertion has not taken place in the antecedent 24 h, women are not menstruating and men have not indulged in sexual intercourse before providing a urine sample will also result in rejection. A urinary abnormality is deemed persistent if it is present on each of three occasions 1 week apart. In these circumstances, and in the absence of past nephro-urological history, the applicant will be referred to their general practitioner with advice that referral to a civilian consultant nephrologist should be arranged. In the absence of any other abnormality, orthostatic proteinuria (and the diagnosis of this may occasionally require careful inpatient assessment) and proteinuria up to 500 mg/24 h (urinary albumin/creatinine ratio <30 mg/mM) will generally be acceptable. In the case of microscopic haematuria, ideally the civilian consultant should undertake examination of the centrifuged urinary deposit as, in the hands of the author, this is a reliable and simple way to distinguish glomerulo-tubular from urological causes. Where renal disease is suspected, this should be investigated as usual and eGFR should be recorded.

The usual civilian criteria should apply to performance of a renal biopsy. This is not a precondition for enlistment or commissioning where renal disease is suspected unless review of an individual case by a military nephrologist indicates that renal biopsy would be essential. Establishment of a diagnosis, however preferable this may be, does not necessarily guarantee acceptance even if the diagnosis is benign. For example, cases do exist of thin basement membrane disease where haematuria is macroscopic and causes attacks of debilitating clot colic but in the absence of such symptoms, nearly all cases of thin basement membrane disease are militarily acceptable. A given case of IgA nephropathy could similarly be associated with clot colic but even if this symptom is absent, renal swelling during a relapse may cause significant stretching of the renal capsule to precipitate debilitating loin ache. This may compromise the safe use of
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A military nephrologist has to ask himself whether a relapse of a particular nephritis attempted to conceal his condition but was surprised to encounter his military nephrologist when a serious exacerbation precipitated by viral gastroenteritis occurred on a military deployment that necessitated urgent repatriation with a fortunately satisfactory outcome with no overall loss of renal reserve. Medical downgrading constrained military service to protected locations.

Fig. 2. Deterioration in renal function in a case of IgA nephropathy. Two episodes of acute deterioration occurring on deployment are seen. At (a) there was an attack of tonsillitis and at (b) there was an attack of gastroenteritis due to Shigella sonnei. As the deterioration of renal function before deployment was minimal in this case, the patient was retained in service but, nevertheless, relapses on deployment were associated with a deterioration in eGFR, which, fortunately, was not critical. There was evidence of a statistically significant (r = −0.81, P = 0.01) but mild overall deterioration of renal function (eGFR) of −1.5 mL/min/1.73m²/year justifying retention in service.

Fig. 3. This military patient with IgA nephropathy/Henoch–Schönlein nephritis attempted to conceal his condition but was surprised to encounter his military nephrologist when a serious exacerbation precipitated by viral gastroenteritis occurred on a military deployment that necessitated urgent repatriation with a fortunately satisfactory outcome with no overall loss of renal reserve. Medical downgrading constrained military service to protected locations.
to conceal their chronic medical problem in the hope that they will retain an operational medical grading and promotion prospects (see Figure 3). Such cases will have had inadequate education about the risk that such concealment confers not only on them but also on their comrades and medical staff who may have the unenviable task of extracting them from dangerous locations.

Some special situations

Non-Caucasian racial origin

There is currently no conscription to serve in HM Forces (but in other countries conscription may exist—see above). All serving personnel are volunteers. It is not possible to adequately recruit from the UK population, which is becoming more racially diverse. In consequence, applicants are welcomed from the Commonwealth, which adds to the racial diversity of the Service population. Nevertheless, irrespective of origin, all applicants should have no evidence of significant renal disease nor hypertension. That being the case, it is interesting that one non-Caucasian racial group develops nephritis in service with an incidence that is 4-fold that seen in Caucasians which remain the majority racial group. There is an impression, as yet unproven, that the severity of renal disease and consequent rate of decline in eGFR is worse on average in non-Caucasian races. The nature of disease is not significantly different. As is well known, even Caucasians can have a relatively fast rate of loss of renal function. This means that particular attention has to be paid to serving non-Caucasian personnel that develop evidence of nephritis and thresholds for biopsy need to be lower and follow-up intervals shorter. Protective military medical gradings may have to be applied sooner.

Single kidney status

Single kidney status is not incompatible with a military career provided the individual is not a transplant recipient. This situation can arise owing to unilateral renal agenesis, severe hypoplasia, reflux damage, obstructive uropathy, trauma or therapeutic nephrectomy. The minimum acceptable eGFR is 60 mL/min/1.73m² and is usually normal (~120 mL/min/1.73m²) in such congenital cases where contralateral compensatory hypertrophy has usually occurred. There must be no evidence of active renal disease. Significant numbers of applicants have a past history of reflux nephropathy or obstructive nephropathy often presenting usually as recurrent urinary tract infection in infancy or childhood. Isotope renography will demonstrate any great inequality of split renal function. If loss of the kidney providing most function would result in the potential for further reduction in renal function, it is interesting that one non-Caucasian racial group develops nephritis in service with an incidence that is 4-fold that seen in Caucasians which remain the majority racial group. There is an impression, as yet unproven, that the severity of renal disease and consequent rate of decline in eGFR is worse on average in non-Caucasian races. The nature of disease is not significantly different. As is well known, even Caucasians can have a relatively fast rate of loss of renal function. This means that particular attention has to be paid to serving non-Caucasian personnel that develop evidence of nephritis and thresholds for biopsy need to be lower and follow-up intervals shorter. Protective military medical gradings may have to be applied sooner.

Adult polycystic kidney disease

Applications from cases of known adult polycystic kidney disease are refused. The requirement for at least annual renal functional assessment, blood pressure control and the possibility of symptomatic cyst rupture together with a risk of associated cerebral aneurysm are potentially incompatible with a full military career. Additionally, personal experience shows that it is quite impossible to predict the duration before requirement for renal replacement treatment is necessary and, thus, the likely duration of any military service. Rates of deterioration in eGFR can vary between −1.77 and −11.53 mL/min/1.73m²/year. In the latter case, rapid deterioration in renal function occurred in a 37-year-old male soldier with newly diagnosed adult polycystic kidney disease whose biological parents were unknown to him, eGFR fell from 65 to 20 mL/min/1.73m² in 4 years despite good blood pressure control. Regular haemodialysis was then commenced and he was eventually discharged from military service on medical grounds.

Infection

Recurrent infection, with or without renal damage or symptoms, will result in rejection of an application. The risk of urinary tract infection will be increased on operations resulting in the potential for further reduction in renal function.

Vascular disease

Occasionally, renal functional impairment will be secondary to reduced renal perfusion secondary to familial muscular dysplasia causing renal artery stenosis. Only one case of this has been encountered in 25 years. The male patient presented with hypertension in childhood. Renal arteriography demonstrated the appearances typical of this condition. Antihypertensive medication was given but the need for this diminished with age such that by the time of application for entry into the army, no medication was necessary and a 24-h ambulatory blood pressure recording was within normal limits as was renal function. His application was accepted. One case of hypertension related to aortic coarctation in a serving member of HM Forces has been encountered. The collateral circulation was so good with renal and lower limb blood flow so unimpaired that his eGFR was
undiminished as was his athletic performance: he was a star sprinter for the Service concerned!

Renal disease arising in serving personnel

Several examples have been given already of renal diseases arising in serving personnel. It should by now be obvious that such patients are retained in service wherever possible so that the public investment in their training is realized. Those whose skills are limited to combat activity will have few alternatives for continued employment. Only a fixed number can be accommodated in non-combat roles and staffing is not unlimited. In times of financial constraint with enduring operational demands, every serving member of HM Forces is needed for operational duties, the author included. However, the nature and severity of challenges and potential insults, which could include use of unconventional weapons (chemical, biological, radiological and nuclear) necessitates a lower threshold to apply a protective medical grading in military personnel. Unit medical officers have ready access to experienced military nephrological and occupational medical advice. The final decision concerning suitability for entry and continuing military service should remain that of the military practitioner who has experience not only of the diseases commonly encountered but also of the scenario where deployment hazards will be confronted and any renal consequences treated.

Acknowledgements. Disclaimer. The views expressed are those of the author and should not be construed as those of HM Government, the Ministry of Defence or their employees.

Conflict of interest statement. None declared.

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Received for publication: 26.7.10; Accepted in revised form: 17.2.11