The cutting (w)edge—comparative evaluation of renal baseline biopsies obtained by two different methods

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Abstract

Background. The assessment of donor-derived damage of transplanted kidneys might be instrumental for estimating donor organ quality and for predicting short- and long-term organ outcome. In the present study, we report a new standardized method for obtaining pre-transplant kidney biopsy specimens. Instead of taking wedge biopsies (WBs), a skin punch biopsy (PB) tool was utilized to obtain standardized biopsy samples that also represented deeper cortical zones.

Methods. We compared 147 PB specimens and 114 WBs with respect to the number of glomeruli and arterial vessels they contained. The performance of the two biopsy methods in detecting glomerular damage, interstitial fibrosis/tubular atrophy (IF/TA) and arteriosclerosis was determined by evaluation of subsequent transplant core biopsies of the patients. Statistical comparison employed Kruskal–Wallis and kappa (κ) tests.

Results. Significantly more PB samples (89%) than WBs (66%) were diagnostically adequate according to the Banff criteria. Despite a higher number of glomeruli in WBs (34.6 versus 21.7 in punch biopsies), arteries were present in only 68% of WBs but could be found in 93% of punch biopsies. The comparison of findings in pre-transplant biopsies with lesions in corresponding post-transplant core biopsies revealed a superior diagnostic concordance for IF/TA and arteriosclerosis for punch biopsies than for WBs, reaching kappa values of 0.823 versus 0.729 and 0.661 versus 0.516, respectively.

Conclusion. The use of skin PB tools for obtaining baseline biopsies from transplanted kidneys is a safe and effective method for assessment of donor-derived damage of the organ.

Keywords: donor-derived damage; kidney transplantation; punch biopsy; sample adequacy; wedge biopsy
Introduction

Histological assessment of kidney graft quality and donor-derived damage is of increasing importance, especially if we consider accepting marginal donors in order to alleviate the pressing shortage of donor organs [1]. A higher prevalence of chronic tissue injury in these grafts has been demonstrated to be associated with an augmented risk of primary non-function and influences short- and long-term clinical outcome of kidney allografts [2]. Presence of glomerular scars [3–6], interstitial fibrosis/tubular atrophy (IF/TA) [7] and arteriosclerosis [7, 8] were shown to be associated with delayed graft function (DGF), increased serum creatinine levels and decreased graft survival.

Pre-transplant donor kidney biopsies (PTDBs) taken at the time of transplantation are a widely accepted tool for assessing donor-derived lesions [9]. Diagnostic accuracy, however, crucially depends on the adequacy of biopsy samples. According to the Banff recommendations, for allograft biopsy specimens, at least 10 glomeruli and 2 small arteries are required to obtain a representative sample [10, 11]. According to recent findings, these requirements are sufficient to assess kidney graft state in PTDBs as well [12]. Histological findings in PTDBs might exert a major influence on the decision about graft acceptance and are a major reason for discarding organs [13, 14]. Availability of adequate biopsy samples thus is of fundamental importance for the histological assessment of kidney graft quality.

At our surgical department, PTDBs are routinely performed. This has been done previously by surgical excision of superficial wedge biopsies (WBs). The size of these biopsies from subcapsular renal cortical tissue may be highly variable. Small biopsies from very superficial regions tend to lack arteries and might be misleading if areas of subcapsular fibrosis are sampled. In a study of Mazzucco et al. [15], comparative evaluation of WB and needle PTDBs showed that core needle biopsies (CNBs) were superior in assessing donor-derived damage. This limitation of WB is particularly relevant for the assessment of arteriosclerotic lesions. However, increasing sample size might lead to a disproportional rise in the risk of serious bleeding complications with need of surgical revisions.

In order to standardize sample size and improve adequacy, the transplant surgical team of the Medical University of Vienna considered the use of skin punch biopsy (PB) devices. These instruments provide a standardized sample size larger than usual core biopsy specimens while leaving a minimal surface defect easily closed by a superficial suture, thus minimizing post-biopsy bleeding complications.

In the present study, we prospectively compared baseline biopsy specimens of 265 transplanted kidneys obtained by either WB (n = 114) or PB (n = 147) procedure with respect to sample size, number of contained glomeruli and small arteries. Patterns of chronic kidney injury were classified as glomerulosclerosis, IF/TA and arteriosclerosis. Accuracy of the two methods in detecting donor-derived damage was evaluated by comparing baseline biopsy specimens with subsequent CNB samples of the patients.

Materials and methods

Patients

Biopsy specimens of 261 consecutive donor kidneys of the General Hospital of Vienna (Medical University of Vienna, Austria) that were transplanted in our hospital between July 2006 and January 2008 were examined histologically to assess donor-derived damage. WB was performed in 114 cases and a PB was obtained from 147 transplanted kidneys. In the course of a WB, renal cortical tissue was removed using a surgical scalpel. To obtain a PB, the Kai® 3-mm skin punch biopsy tool (Integra-Miltex, Plainsboro, NJ) was utilized. The biopsy procedure is illustrated in Figure 1. Characteristics of biopsy specimens and transplant recipients are summarized in Table 1.

Histology

Biopsy specimens were obtained at the time of transplantation from accepted grafts to be implanted and were routinely fixed in 4.5% phosphate-buffered formaldehyde with subsequent paraffin embedding for microscopic evaluation. Sections were stained using three different methods for all specimens: standard haematoyxin-eosin, periodic acid-Schiff and the trichrome stain acid fuchsin orange-G. All slides were evaluated by two independent pathologists for size as well as for donor-derived damage.

PTDB evaluation

Samples were assessed for the number of glomeruli, glomerular scars and arteries. Adequacy of samples was defined according to the Banff classification, which requires at least 10 glomeruli and 2 small arteries for an adequate biopsy. Arteries were defined by the presence of two or more layers of smooth muscle cells in the tunica media. In addition, the following lesions were graded based on a semiquantitative scale (0 = absent, 1 = mild, 2 = moderate, 3 = severe): glomerular damage, IF/TA and arteriosclerosis. Chronic tissue injury seen in the pre-transplant biopsies was documented as donor-derived damage.

Follow-up biopsies

To determine the reliability of the two different pre-transplant biopsy methods, subsequent CNB samples of the transplanted organs (taken within 2 months post-transplantation) were evaluated with respect to chronic tissue injury. These post-transplant CNB specimens were not processed into biopsies but were obtained according to standard clinical indications upon symptoms of graft dysfunction that raised the suspicion for acute graft rejection. Such symptoms were most frequently DGF or rise in serum creatinine levels. Within the time frame of 2 months, glomerular scars, IF/TA and arteriosclerosis in a graft biopsy are more likely to be donor-derived rather than representing kidney damage acquired after transplantation. Presence and severity of lesions in graft biopsies were compared to the findings in the respective PTDBs semiquantitatively and according to the Banff ‘05 criteria. In this evaluation, mild discordance was defined as a change by one grade in the IF/TA category and moderate discordance was stated as a change by two grades.

Statistical analysis

Patient and biopsy data were documented using FileMaker Pro 8.0 (FileMaker, Inc., Santa Clara, CA) and analysed using GraphPad Prism 4 software for Windows (GraphPad Software, Inc., San Diego, CA). Patient and biopsy data were analysed semiquantitatively for presence or absence of tissue damage. Student’s t-test, Kruskal–Wallis test for non-parametric values and agreement between two biopsies of the same patient with the kappa (κ) test were performed using PASW Statistics 18.0. Kappa with linear weighting was performed when the evaluation had more than two entries for one of the observed data. P-value < 0.05 was considered significant.
Results

PB samples are smaller but the rate of adequate samples is superior to WB

For all biopsy specimens, number of glomeruli, glomerular scars and arteries were determined. A total of 98/261 (37.5%) biopsy specimens were classified insufficient according to the Banff criteria mostly due to the lack of arteries. From the samples, 42.1% of WB specimens and 7.4% of PBs did not contain arteries, and 1 PB and 1 WB specimen did not contain any arterial vessels at all. Inadequacy was significantly less common in PB (25/147, 17%) than WB specimens (73/114, 64%). In the remaining cases, scarcity of glomeruli (<10) constituted the reason for inadequacy.

PB samples contained a mean number of 21.7 glomeruli compared to 34.6 glomeruli in WBs. By statistical analysis, PBs were smaller but showed significantly less size variation as indicated by the number of glomeruli contained (P < 0.05). Size distribution of biopsy specimens, as measured by the number of glomeruli contained, is shown in Figure 2A.

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However, there was no significant difference between WB (1.9) and PB (1.8) specimens concerning the number of small arteries contained. Distribution of biopsies

Fig. 1. Baseline biopsy sampling of a kidney graft using a skin PB device. (A) Kai® Sterile Dermal Biopsy Punch, 3 mm; (B–F) PB sample extraction; (G) closure of the biopsy defect by suture.

Table 1. Characteristics of patients and PTDB specimens

<table>
<thead>
<tr>
<th></th>
<th>Punch</th>
<th>Wedge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number</td>
<td>147</td>
<td>114</td>
</tr>
<tr>
<td>Male/female (n)</td>
<td>107/42</td>
<td>81/33</td>
</tr>
<tr>
<td>Male/female (%)</td>
<td>72.4/28.6</td>
<td>71.1/28.9</td>
</tr>
<tr>
<td>Median age in years (range)</td>
<td>50.1 (5–78)</td>
<td>50.5 (4–78)</td>
</tr>
<tr>
<td>Donor-derived damage, n (%)</td>
<td>80 (54.4)</td>
<td>64 (56.1)</td>
</tr>
<tr>
<td>Inadequate biopsies, n (%)</td>
<td>17 (11.0)</td>
<td>39 (34)</td>
</tr>
<tr>
<td>Serious adverse events, n (%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*aConcerning biopsy location, requiring surgical revision.*
according to the number of small arteries is depicted in Figure 2B.

Subsequent CNBs contained a mean number of 18.2 glomeruli and 2.3 arteries. The mean number of glomeruli and arteries in different types of biopsy material is shown in Figure 2C.

**Initial evaluation of donor-derived damage**

The presence of donor-derived histological damage at the time of transplantation was comparable in both PTDB cohorts (t-test, $P=0.46$). In WB specimens, donor-derived damage of the transplanted kidney was diagnosed in 64 cases (56.1%), whereas 80 PB specimens displayed donor-derived changes (54.4%).

In PB specimens, arteriosclerosis was the most frequent type of injury affecting 65 samples (44.5%). Glomerulosclerosis and IF/TA were present in 28 (19%) and 30 (20.4%) cases, respectively.

A different pattern of lesions was found in WB, with glomerulosclerosis being the most frequent change, affecting 48 samples (42.1%). IF/TA and arteriosclerosis were diagnosed at an equal frequency [29 samples (25.4%)].

According to these results, arteriosclerosis was significantly more frequent ($P<0.001$) and glomerulosclerosis less frequent ($P<0.001$) in PB than in WB specimens.

Comparison of tubulointerstitial chronic damage in WB versus dermal PB and post-transplant core biopsies is shown in Figure 3.

**Concordance with subsequent CNB**

To assess the diagnostic reliability of WB and PB samples for chronic tissue injury, PTDB specimens were compared to subsequent CNB obtained <2 months after transplantation. In cases with discordant PTDB and CNB damage patterns, the median number of days between transplantation and follow-up biopsy was 7 in the case of PB and
12.5 for WB. Therefore, it is highly unlikely that chronic lesions observed in early post-transplant biopsies derive from de novo injury.

Tissue injury observed in post-transplant biopsies was different from the findings in PTDB in 40.7% of patients with WB but only in 25.2% with PB (P < 0.01).

Concordance between PTDB and CNB is described in detail in Table 2. Overall concordance rates ranged from 79.3% regarding diagnosis of arteriosclerotic lesions to 92 and 95.4% for IF/TA and glomerulosclerosis, respectively.

Agreement rates were higher in all categories for PB than for WB. Interestingly, IF/TA and arteriosclerosis were more frequently of higher grade in subsequent CNB samples, whereas for glomerulosclerosis, overestimation and underestimation of donor-derived damage were equally represented.

κ values were higher for IF (0.823—almost perfect agreement versus 0.746—substantial agreement, respectively) and arteriosclerosis (0.661—substantial agreement versus 0.512—moderate agreement, respectively) in PB than in WB specimens (Table 3). κ values for glomerulosclerosis were comparable (0.868 versus 0.892, respectively).

Analysis of concordance between PTDBs and subsequent CNBs according to the Banff ’05 criteria did not alter these findings substantially. In the PB cohort, 31 of 40 patients showed mild discordance and 9 patients showed moderate discordance.

Impact of acute graft rejection on discordant chronic injury patterns

Incidence of acute graft rejection according to the Banff ’05 classification is summarized in Table 4.

In the PB cohort, one patient upgraded for IF/TA had borderline changes suspicious for rejection which was diagnosed by CNB 6 days after transplantation. For arteriosclerosis lesions, 5 of 20 patients in the upgraded category had Type IIA acute T-cell-mediated vascular rejection (median time to CNB 5 days after transplantation). Additionally, two patients upgraded for arteriosclerosis were diagnosed with borderline changes suspicious for rejection (median time to CNB 8.5 days after transplantation).

In the WB cohort, 1 patient of 10 upgraded for IF/TA had borderline changes suspicious for rejection (time to CNB 14 days) and 1 patient had acute Type IIA T-cell-mediated vascular rejection (time to CNB 27 days). The only patient with downgraded arteriosclerotic lesions had borderline changes suspicious for rejection that was diagnosed by CNB 7 days after transplantation. In the upgraded cases, seven patients had borderline changes suspicious for rejection (median time to CNB 9.5 days, for discordant lesions see Table 4), one patient had Type I acute T-cell-mediated rejection (time to CNB 39 days) and five patients were diagnosed with Type II acute T-cell-mediated vascular rejection (median time to CNB 9 days).

**Table 2.** Diagnoses of donor-derived damage in PTDB samples according to biopsy method and the tissue compartment affected, revised diagnoses according to subsequent CNB

<table>
<thead>
<tr>
<th>Donor-derived damage</th>
<th>All samples, n = 261</th>
<th>WB, n = 114</th>
<th>PB, n = 147</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Identical</td>
<td>Downgraded</td>
<td>Upgraded</td>
</tr>
<tr>
<td>Glomerulosclerosis (%)</td>
<td>246 (95.4)</td>
<td>6 (2.3)</td>
<td>6 (2.3)</td>
</tr>
<tr>
<td>IF/TA (%)</td>
<td>240 (92)</td>
<td>4 (1.5)</td>
<td>17 (6.5)</td>
</tr>
<tr>
<td>Arteriosclerosis (%)</td>
<td>207 (79.3)</td>
<td>6 (2.3)</td>
<td>46 (17.6)</td>
</tr>
</tbody>
</table>

**Table 3.** Concordance between PTDB and corresponding subsequent CNB samples (Cohen’s kappa test, 95% confidence interval)

<table>
<thead>
<tr>
<th>Donor-derived damage</th>
<th>κ index for all samples, n = 261</th>
<th>κ index for PB, n = 114</th>
<th>κ index for WB, n = 147</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glomerulosclerosis</td>
<td>0.889 (0.83-0.95)</td>
<td>0.868 (0.76-0.97)</td>
<td>0.892 (0.81-0.98)</td>
</tr>
<tr>
<td>IF/TA</td>
<td>0.787 (0.70-0.87)</td>
<td>0.825 (0.71-0.93)</td>
<td>0.746 (0.62-0.88)</td>
</tr>
<tr>
<td>Arteriosclerosis</td>
<td>0.602 (0.51-0.69)</td>
<td>0.661 (0.54-0.78)</td>
<td>0.512 (0.37-0.66)</td>
</tr>
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</table>
Discussion

Chronic tissue damage detected in PTDB specimens can serve as a measure of donor organ quality and might even help in predicting early and long-time kidney graft survival [2, 16], although the reports on its predictive value are controversial [17, 18]. Moreover, the implementation of renal baseline biopsies into renal transplantation protocols provides pathologists with very useful data concerning donor kidney injury [19]. This information is of crucial importance when judging subsequent kidney biopsies of the same patient and is the only way to separate pre-existing damage from lesions acquired after transplantation. Representative PTDBs alerting physicians of new onset of pathological processes and might thus help in guiding therapeutic decisions [20].

Therefore, reliable assessment of donor-derived damage of transplanted organs is an important aspect of the management of transplanted patients and new methods are required to obtain reliable PTDBs [21]. This procedure has traditionally been performed by wedge excision. WBs, however, might bear multiple disadvantages both for the patient and for the reporting pathologist. Due to the lacking perfusion of the explanted organ, the operating surgeon can remain unaware of injuries to larger arterial vessels with the possibility of causing serious bleeding complications. To our knowledge, there are no current studies addressing safety issues of PTDB; however, injury of deeper situated, larger vessels by WB or CNB cannot be theoretically ruled out as a possible complication. At the same time, if the WB is too superficial, larger arterial vessels may not be sampled, depriving the pathologist from properly assessing donor-derived arteriosclerosis. In addition, diagnostic accuracy has been shown to be strongly influenced by WB sample size, as WBs containing <25 glomeruli were proven unreliable in prognosticating graft survival [22]. WB has also been shown to overestimate chronic tissue damage such as glomerulosclerosis and IF/TA that are more prevalent in superficial areas, leading to an unjustified dismissal of the graft [23].

Recent trials suggested the superiority of CNB in representative sampling of the transplanted kidney. Mazzucco et al. [15] reported improved reliability of CNB upon analysis of non-transplanted cadaveric kidneys, which were histologically examined after being rejected for different reasons. Haas et al. [24] compared PTDBs to early post-transplant CNBs with respect to chronic vascular damage with similar results. Yushkov et al. [25] describe an improved needle biopsy technique to yield PTDBs at the time of transplantation using a 14-gauge automatic biopsy needle in an exactly defined manner. Although two of the above groups suggest an oblique position of the biopsy needle for tissue extraction, Yushkov et al. specify an angle of 15°–20° to obtain an optimal biopsy. However, the use of a CNB device for sampling of unperfused organs requires considerable experience and estimating the right angle for positioning the biopsy needle can hardly be standardized. Therefore, simplifying and standardizing the PTDB method are likely to improve adequacy of biopsy samples. In this study, we propose a novel and safe PTDB procedure for sampling kidney allografts and suggest the superiority of our method by comparing it to the traditional WB procedure. In contrast to the study of Mazzucco, our investigation was performed in a clinical setting with actual transplanted organs.

In our study, evaluation of PTDBs was performed semiquantitatively by two experienced pathologists, as opposed to a morphometric evaluation, as the latter could not improve the predictive power of the analyses [26].

The size of WB was comparable in all three studies as well as the number of glomeruli contained in core needle and punch PTDBs. The larger number of glomeruli reported by Yushkov et al. is explained by the fact that for this procedure, two separate biopsy specimens had been procured. As in previous studies, WBs in our analysis displayed a significantly larger surface area, which was indicated by the higher mean number of glomeruli contained with respect to PB and CNB as well. However, there was no significant difference in the number of small arteries, reflecting a more superficial tissue sampling by WB.

In two of the previous studies, adequacy of the WB and CNB specimens according to the Banff criteria was not reported. In the small cohort that Haas et al. [24] examined for the presence of vascular lesions, 2 of 39 WB specimens (5.1%) did not contain arterial vessels at all. In our WB cohort, 42.1% of the biopsy samples were inadequate due to the lack of arteries (characterized by the presence of two or more smooth muscular cell layers). In contrast, only 7.4% of PB samples did not contain arteries. One WB (0.8%) and one PB specimen (0.6%) did not contain any arterial vessels at all. Thus, our results show that the proposed PB procedure is able to gain representative samples despite extracting smaller tissue

Table 4. Incidence of acute graft rejection according to the Banff ‘05 classification in patients with discordant PTDB and CNB findingsa

<table>
<thead>
<tr>
<th>Rejection, n (%)</th>
<th>PB (n = 40)</th>
<th>WB (n = 45)</th>
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<tbody>
<tr>
<td></td>
<td>IF/TA↓</td>
<td>IF/TA↑</td>
</tr>
<tr>
<td>Banff borderline (%)</td>
<td>1 (2.5)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Banff Type I (%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Banff Type II (%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Banff AMR (%)</td>
<td>0</td>
<td>0</td>
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</table>

a↓, downgraded; ↑, upgraded; AMR, antibody-mediated rejection; AS, arteriosclerosis; GS, glomerulosclerosis.
fragments. Moreover, the size of the PB samples was subjected to significantly less variation, indicating the feasibility of a standardized biopsy procedure.

The presence of donor-derived histological damage at the time of transplantation was comparable in both of our PTDB cohorts and corresponds with previously reported data [3, 20, 27]. Upon evaluation of subsequent core biopsies of the transplanted organs, diagnoses were more frequently revised in WB than PB samples. For both methods, diagnostic concordance indicated by Cohen’s 𝜅 index was highest for glomerulosclerosis, followed by IF/TA and arteriosclerosis. Our observations differ from previous findings, where highest concordance was detected for vascular damage for CNB and WB samples as well. In general, Cohen’s 𝜅 index values tended to be higher in our cohort than reported in previous study, despite of comparable overall biopsy size. Since chronic tissue lesions might be acquired de novo due to injury after transplantation, we also assessed the presence of rejection in follow-up CNB specimens with discordant readings and found that diagnosis of T-cell-positive antibody-mediated rejection had a low prevalence of up to 12.5% in our cohorts. Moreover, median time to performing CNB was 7 days in case of PBs and 12.5 days for WBs, rendering immune-mediated processes unlikely to contribute to the chronic tissue damage observed.

Regarding the reliability of CNB versus WP, both previous studies confirmed the improved efficacy of a CNB procedure. However, whereas WB outperformed CNB in the assessment of IF/TA, our result show that PB is more efficient in detecting donor-derived damage in all tissue compartments. The larger width of the skin PB tool likely allows a more adequate sampling of the cortical zone, which could be responsible for this effect. At the same time, the size and construction of the skin PB device automatically prevents too deep a penetration, minimizing the risk of large vessel injury. The procedure can be easily taught and is not associated with increased costs.

We conclude that PTDB obtained by a skin punch device is more reliable for assessing donor-derived damage of transplanted kidneys. This procedure provides a safe method for avoiding bleeding complications due to their limited depth and simple post-biopsy management by sutural closure. The main advantage of the PB lies in the standardization of this method to circumvent inter- and intrapersonal variability concerning biopsy size. From the pathologist’s and surgeon’s point of view, we can recommend the implementation of this method for obtaining baseline biopsy samples of transplanted kidneys.

Conflict of interest statement. None declared.

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doi: 10.1093/ndt/gfs073
Advance Access publication 20 April 2012

Survival analysis and causes of mortality in patients with lupus nephritis

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Abstract

**Background.** This study aimed to define the causes and associated risks of death compared with the local general population in Chinese patients with lupus nephritis in the recent era.

**Methods.** The records of all lupus nephritis patients followed in a single centre during 1968–2008 were reviewed. The causes of death were identified, the survival curves constructed and the standardized mortality ratios (SMRs) of potential risk factors were calculated with reference to the local general population.

**Results.** Two hundred and thirty systemic lupus erythematosus patients with history of renal involvement (predominantly Class III/IV lupus nephritis with or without membranous features) were included. The follow-up was 4076.6 person-years (mean 17.7 ± 8.9 years). Twenty-four patients (10.4%) died, and 85% of the deaths occurred after 10 years of follow-up. The 5-, 10-, and 20-year survival rates were 98.6, 98.2 and 90.5%, respectively. The leading causes of death were infection (50.0%), cardiovascular disease (20.8%) and malignancy (12.5%). The renal survival rates at 5, 10 and 20 years were 99.5, 98.0 and 89.7%, respectively. The SMR in patients with renal involvement, end-stage renal disease (ESRD), malignancy or cardiovascular disease was 5.9, 26.1, 12.9 and 98.0 and 89.7%, respectively. The SMR in patients with history of renal involvement (previously treated) was 5.1, 10.4 and 13.6, respectively.

**Conclusions.** Lupus nephritis is associated with a 6-fold increase in mortality compared with the general population. Lupus patients who develop ESRD have a 26-fold excess in the risk of death, which is more than twice the risk associated with malignancy or cardiovascular disease in these patients.

**Keywords:** end-stage renal disease; lupus nephritis; mortality; risk factor; systemic lupus erythematosus

Introduction

Systemic lupus erythematosus (SLE) is an important cause of renal parenchymal disease in young adults and a leading cause of secondary renal disease resulting in chronic renal failure in Asians. Previous studies reported that 30–50% of SLE patients had renal involvement, while 10% of lupus patients would eventually develop end-stage renal failure [1, 2].

Over the past few decades, the survival of lupus nephritis patients has improved significantly because of advances in immunosuppressive and supportive treatments, better socio-economic conditions and earlier diagnosis. The causes of death have also changed. Early mortality due to uncontrolled disease or acute renal failure is now rare. While infection remains an important cause of mortality, with longer patient survival cardiovascular complications have emerged as important causes for late mortality [3, 4].

There is relatively little long-term information on the mortality rate and the causes of death in Chinese patients with lupus nephritis. This retrospective single-centre study compares the survival of patients with lupus nephritis against age- and gender-matched controls in the general population, in the era of effective immunosuppressive treatment regimens, and defines the causes of excessive mortality. The data are prerequisite to designing interventions to improve long-term patient survival.

Materials and methods

The inpatient and outpatient records of all patients who had attended the SLE clinic of Queen Mary Hospital within the period 1968–2008 were reviewed. Over 80% of the SLE patients managed at this clinic had a history of lupus nephritis and only patients with renal involvement were included in this analysis. All patients included in our study were ethnic...