The outcome of total hip and knee arthroplasty in diabetics

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Summary Patients with diabetes have a higher rate of deep infection. The routine use of prophylactic antibiotics, antibiotic loaded cement and a modern operating environment, however (laminar air flow with or without clean air) should make the risk less significant. In addition extra care should be taken on handling of the skin (especially around the knee) and the appropriate sutures and suturing technique adopted.

The rate of aseptic loosening is higher in diabetic patients and is most likely due to the neuropathy in these patients. The patients and surgeon should be aware of this increased risk.

Introduction

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are among the most common major operations performed by the United Kingdom (UK) National Health Service (NHS). The numbers, both in the NHS and private healthcare sector, have soared over the last 10 years and are expected to continue rising over the next 25 years. One of the key reasons is due to an increasing aged population.

The prevalence of diabetes mellitus is also rising. It is estimated that currently 1.4 million in the UK suffer from diabetes with a further 1 million undiagnosed, 'the missing million' i.e. approximately 4% of the population. This is expected to rise over the next decade. Worldwide over 150 million have diabetes, expected to rise to 300 million by 2025. The majority of this increase will be in the developed nations including the United Kingdom. This reflects unhealthy diet, obesity, sedentary lifestyle and the population ageing.

Overall diabetes is a global health problem that is expected to present one of the 21st century’s biggest medical challenges.

It follows from these figures that the number of THAs and TKAs performed in diabetics will also increase substantially but as yet very little has been reported about the outcomes and complication rates of THAs and TKAs performed on this particular subset of arthroplasty patients. In this paper we shall discuss briefly trends in total hip and knee arthroplasty and the epidemiology and pathophysiology of diabetes before reviewing the literature.
on the outcome of diabetics undergoing THA or TKA with particular reference to infection.

Trends in total knee and hip arthroplasty

THA and TKA are cost effective treatments for disability secondary to joint arthroses, reducing pain, increasing mobility and improving quality of life. In the NHS alone more than 43,000 primary THAs were performed last year. This figure has risen from 32,000 in 2000 and that figure is expected to rise by a further 22% to 53,000 by 2010. TKA is also on the increase. Between 1991 and 2000 the incidence of primary TKA has more than doubled and that figure is expected to increase from the 2003 figure of 35,000 primary TKAs by 60% to 56,000 by 2010 overtaking hip replacements as the most common primary arthroplasty operation. Similar trends have been reported in Australia, USA and Scandinavia.

The greatest increase in rates of primary THAs and TKAs have been in those aged 55–64 and in those over 80 with a growing number in the over 85s. Undoubtedly, as surgical and anaesthetic techniques and outcomes improve, even more elderly people will undergo THA and TKA. Increasing age is a risk factor for the development of diabetes and thus this group of elderly patients (over 85s) will have a higher prevalence of diabetes than the population in general. Risk of adverse outcomes of THAs or TKAs in the diabetic population may be amplified in a fragile group of patients.

Epidemiology and pathophysiology of diabetes

Diabetes is already a global health problem likely to increase markedly over the next 25 years. In 1985, an estimated 30 million worldwide had diabetes. That figure today is over 150 million with the projected number to be over 330 million in 2025. Prevalence is higher in developed countries, but is projected to rise in both developed and developing countries. In the UK the number of people diagnosed with diabetes is around 1.4 million with a further 1 million thought to have undiagnosed diabetes. It is characterized by abnormal glycaemic control either as a result of insulin deficiency (Type 1) or insulin resistance of the peripheral tissues (Type 2). By far the most common is Type 2 diabetes, which account for 85–95% of all diabetics.

Risk factors for the development of diabetes

- **Age:** Prevalence of diabetes increases with age, with an average age of diagnosis at 51 years.
- **Obesity:** As a nation, the UK is increasingly overweight and less active, which is associated with an increase in diabetes.
- **Familial:** Type 2 diabetes tends to run in families. One study showed that in newly diagnosed with Type 2 diabetes between the ages of 25 and 65, almost half (41%) had a close relative with diabetes.
- **Ethnic:** Diabetes is 3–5 times more common among people of African-Caribbean and Asian origin living in the UK.

Complications of diabetes

Most of the common complications of diabetes (retinopathy, nephropathy, coronary heart disease, peripheral vascular disease, foot disease and peripheral neuropathy) are mediated by changes to the structure of small to medium blood vessels. Experimental studies have shown defects in the host-defense mechanisms of diabetics including impaired leucocyte function specifically phagocytosis. The adverse affects of hyperglycaemia on fracture healing and bone remodeling have also been well demonstrated in experimental and clinical studies. More recently it has been recognized that diabetes causes changes in collagen metabolism with the net result of increased collagen cross-linking, changing the chemical and mechanical behaviour of this tissue. All these factors may be implicated in the recognized higher rate of surgical wound complications reported in diabetics.

The ratio of HbA1c (glycosylated haemoglobin), expressed as a percentage, relative to the normal (unglycosylated) haemoglobin should be less than 5 in normal individuals. This ratio used as a measure of glycaemic control. Although a useful measurement to estimate glycaemic control over a period of time, there is no evidence in the literature to our knowledge that correlates poor diabetic control with poorer outcomes after THAs and TKAs. The duration of diabetes from onset is the single most important factor related to the development diabetic complications and it is these complications that may affect outcome from this type of surgery.
Total hip and knee arthroplasty in diabetics

When undertaking total hip and knee arthroplasty in diabetics it is important that patients are carefully managed. We have established guidelines and summarize the key points from the protocol used in our hospital below. The aims of diabetic care in patients undergoing surgery are to avoid hypoglycaemia and ketoacidosis.

At the pre-assessment stage, in addition to the normal tests and examinations, we document whether non insulin or insulin-dependant diabetes mellitus (NIDDM or IDDM) and ascertain recent glycaemic control by measuring HbA1c. IDDM and patients with poor glycaemic control may well need more intensive monitoring during the perioperative phase.

Patients should be admitted a day before surgery and all routine blood investigations repeated. An insulin sliding scale is commenced 2h before surgery, the patient should be operated first on the list and the sliding scale continued until the patient is alert and able to eat, or glucose levels are stable, after surgery. Otherwise postoperative care is the same as for any other patient undergoing this form of major surgery.

Total hip arthroplasty in diabetics

The literature suggests the diabetic patients undergoing THA have an increased risk of infection. However most authors reviewed overall risk factors in patients undergoing THA and, to the authors knowledge, only two papers have looked at the infection in patients undergoing THA and, to the authors knowledge, only two papers have looked at the outcome of THA in diabetics. At the pre-assessment stage, in addition to the normal tests and examinations, we document whether non insulin or insulin-dependant diabetes mellitus (NIDDM or IDDM) and ascertain recent glycaemic control by measuring HbA1c. IDDM and patients with poor glycaemic control may well need more intensive monitoring during the perioperative phase.

Patients should be admitted a day before surgery and all routine blood investigations repeated. An insulin sliding scale is commenced 2h before surgery, the patient should be operated first on the list and the sliding scale continued until the patient is alert and able to eat, or glucose levels are stable, after surgery. Otherwise postoperative care is the same as for any other patient undergoing this form of major surgery.

Moecckel et al. reported a retrospective analysis of 81 THAs in 69 patients. Patients with rheumatoid arthritis and other inflammatory arthritis (1 hip) were excluded to better assess the outcome in those diabetic patients with diagnoses of osteoarthritis. They used the Hospital for Special Surgery Hip Rating System and radiographically (by Johnston et al.) Revision for whatever reason was considered a failure, and the clinical results were classed as poor. The mean follow up period was 4.1 years, (range 2–6.5 years). The mean preoperative HSS hip score was 16 while the mean postoperative HSS hip score was 35. Sixty-three THAs were rated as excellent, 15 as good and 3 as poor. All 3 poor hips were revised (revision rate of 3.7%). There were no cases of deep or superficial infection. Three revisions were performed for aseptic loosening or recurrent dislocation. Radiolucentencies were documented around 3 stems (3.7%) and 18 cups (22.2%). Only one stem and one cup were revised for aseptic loosening. As with other studies they reported a high rate of perioperative complications including UTI (10 patients), MI (5 patients), DVT (2 patients) giving an overall incidence of 24.3% for medical complications.

We looked at 1247 non-diabetics and 82 diabetics prospectively over 6 years with at least 3 years follow up, average 3.6 years. At a pre assessment clinic 7–10 days preoperatively, height, weight, body mass index (BMI), medical history, SF 36 and Harris hip scores were recorded.

All patients were treated in the Victoria Hospital, Kirkcaldy, Fife in an operating theatre equipped with vertical laminar flow with ultra clean-air. All patients had 1g ceftriaxone on induction of anaesthesia or gentamicin if allergic and had a cemented prosthesis implanted using gentamicin-loaded cement (Palacos). Low molecular weight heparin (Dalteparin 5000 U) was continued until discharge.

Patients were reviewed at a dedicated hip clinic by an audit nurse at 6,18 and 36 months post operatively. Data was collected on the rate of deep and superficial infection. Superficial infection was defined as either clinical erythema and/or oedema of wound and/or persistent wound drainage with or without a positive swab result. Deep infection was defined as either a positive aspirate from the hip, or where a second procedure has been performed which clinically indicated infection. Deep infection was further subdivided into early deep infection (within 3 months of operation) or late (after 3 months). Other complications such as dislocation and loosening were noted.

There was no significant difference with respect to age, sex and diagnosis between the two groups but diabetic patients did have a significantly higher BMI (30.2 vs 27.7, P<0.001) and higher incidence of coronary artery disease (31% vs 15%, P<0.001 (Table 4).

There was no increase in the rate of deep periprosthetic infection, superficial infection, dislocation, blood loss and DVT between diabetics and
non-diabetics even after adjusting for potential confounders of age, sex, diagnosis, BMI and the presence of coronary artery disease and there was no difference in the outcome in IDDM and NIDDM. However diabetic patients had a longer in patient stay following THA, (10.7 days vs 9.6 days). This is similar to the findings of Forrest et al. 21

Conclusions
While a number of publications have shown an increased risk of infection in diabetic patients undergoing THA,16,18 they did not look specifically at diabetic patients. 19 There is only one recent publication looking specifically at diabetic patients.19 Taken together these papers suggest that with modern techniques, there is no increased risk of infection. Our findings20 confirm this view. However, Moeckel et al.19 did show a high radiographic loosening rate. This may suggest that diabetic patients may be prone to early loosening. More research is needed in this area, in particular longer follow up studies. We plan to continue monitoring our cohort of diabetic patients.

Total knee arthroplasty in diabetics
To date, there have been relatively few studies reporting on the outcome of TKA in diabetics (Table 1). Most have been retrospective and the numbers have been small, but the most recent study by Meding et al.27 was by far the largest and included 329 TKAs performed on diabetic patients.

Wound complications
The combination of impaired host defenses, thin capsule and subcutaneous tissue and variability of the blood supply to the skin around the knee, suggest wound complications should be higher in diabetics with a theoretical higher risk of developing into a deep infection. However, there has been no correlation shown between postoperative wound complications and the development of deep infection in any of the published studies. The rate of reported superficial wound complications in diabetics after THA varied from 1.2% to 12% 1,14,17,22–30 (Table 1) which is comparable to TKAs performed on non-diabetics which have been reported as high as 10–20%.31–33 Meding et al.27 reported twice as many wound complications in IDDM but concluded that the numbers were so small to preclude statistical analysis. No other studies have mentioned a difference in rate of wound complications between diabetics and non-diabetics. With the close proximity of the skin and thin subcutaneous tissue to the knee joint itself, a common sense approach of treating any superficial infection aggressively should be adopted. Other factors are also important. Meticulous skin handling, minimizing trauma to the tissues, using mono filament nylon and interrupted sutures also plays an important role in reducing the rate of wound complications in all patients undergoing TKA.34

Deep infection
There are many factors that may influence the development of deep infection including bacterial virulence, the host’s ability to eliminate infection and the wound environment. The use of prophylactic antibiotics in reducing the rate of deep infection is well established,34 but lactic antibiotics remains controversial.34 Despite this, in view of the reported increased rate of deep infection of TKAs in diabetics it would seem reasonable that as many precautions are taken as practicable. Thus, preoperatively, skin ulcers etc which are more common in diabetics and are a source of potential metastatic infection should be treated. We would advocate the use of a broad spectrum antibiotic given ideally 30 min before surgery and 10 min before inflation of a tourniquet34 and the use of an antibiotic-loaded cement (either pre-loaded or mixed at time of surgery), as a minimum during the perioperative phase.

The overall rate of deep infection reported in the literature for TKA is 0.7–2%.17–30 In the diabetic population the mean rate of deep infection reported is 4.5%22–27 ranging from 1.2%27 to 13.5%.22 The latter was reported by Chiu et al.22 which is the only randomised prospective trial looking at rate of infection of TKA within the diabetic population comparing the use of cefuroxime-loaded cement and plain cement. Five out of 41 (13.5%) patients developed deep infection in the group who received plain cement, while none of 41 patients with cefuroxime-loaded cement developed infection. The overall infection rate for the whole group was 5 out of 78 (6.4%).

The place of antibiotic-loaded cement in diabetic patients is unclear; one study has reported that intravenous cefuroxime is just as effective as cefuroxime added to the cement.35 Meding et al.27 found a slightly higher infection rate in their diabetic group (1.2% vs 0.7%), but the difference was not significant. All 4 patients who developed deep infection had cefuroxime-impregnated cement, while only 74% of the non-diabetic infected patients had antibiotic-loaded cement. Yang et al.23 reported using gentamicin-loaded
Table 1  Publications on total knee replacements in diabetic patients.

<table>
<thead>
<tr>
<th>Patients</th>
<th>Chiu et al.\textsuperscript{22}</th>
<th>Yang et al.\textsuperscript{23}</th>
<th>Pagagelopoulos et al.\textsuperscript{24}</th>
<th>Serna et al.\textsuperscript{25}</th>
<th>England et al.\textsuperscript{26}</th>
<th>Meding et al.\textsuperscript{27}</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDDM</td>
<td>67 (10%)</td>
<td>86</td>
<td>51</td>
<td>48</td>
<td>46</td>
<td>291</td>
</tr>
<tr>
<td>NIDDM</td>
<td>60 (90%)</td>
<td>7 (8%)</td>
<td>12 (24%)</td>
<td>8 (17%)</td>
<td>6 (13%)</td>
<td>118 (36%)</td>
</tr>
<tr>
<td>Age</td>
<td>71</td>
<td>69</td>
<td>Not reported</td>
<td>67</td>
<td>68</td>
<td>70</td>
</tr>
<tr>
<td>Follow up (Years)</td>
<td>4.2</td>
<td>3.6</td>
<td>8</td>
<td>4.5</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Numbers of TKAs</td>
<td>78</td>
<td>109</td>
<td>68</td>
<td>53</td>
<td>59</td>
<td>329</td>
</tr>
<tr>
<td>Superficial infection</td>
<td>2.6%</td>
<td>7.3%</td>
<td>2.5%</td>
<td>5.7%</td>
<td>12%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Deep infection</td>
<td>6%</td>
<td>5.5%</td>
<td>1.5%</td>
<td>5.7%</td>
<td>6.8%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Aseptic loosening</td>
<td>0</td>
<td>2%</td>
<td>7%</td>
<td>2%</td>
<td>3%</td>
<td>3.6%</td>
</tr>
<tr>
<td>HSS Pre op</td>
<td>51</td>
<td>48</td>
<td>53</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Post op</td>
<td>91</td>
<td>86</td>
<td>77</td>
<td>83</td>
<td>85</td>
<td>92</td>
</tr>
<tr>
<td>KSS knee/pain</td>
<td>Not reported</td>
<td>D</td>
<td>ND</td>
<td>D</td>
<td>ND</td>
<td>D</td>
</tr>
<tr>
<td>Pre op</td>
<td>37</td>
<td>37</td>
<td>77</td>
<td>83</td>
<td>85</td>
<td>92</td>
</tr>
<tr>
<td>Post op</td>
<td>79</td>
<td>77</td>
<td>37</td>
<td>37</td>
<td>77</td>
<td>83</td>
</tr>
<tr>
<td>KSS function</td>
<td>Not reported</td>
<td>D</td>
<td>ND</td>
<td>D</td>
<td>ND</td>
<td>D</td>
</tr>
<tr>
<td>Pre op</td>
<td>44</td>
<td>43</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Post op</td>
<td>64</td>
<td>57</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Type of study</td>
<td>Prospective Randomized Trial\textsuperscript{1}</td>
<td>Retrospective</td>
<td>Retrospective (Matched Control Group)</td>
<td>Retrospective (Matched Control Group)</td>
<td>Retrospective</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Revision rate</td>
<td>Not reported</td>
<td>9.2%</td>
<td>7.4%</td>
<td>6.3%</td>
<td>10%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

\textsuperscript{D, diabetics; ND, non diabetics.}

All the reports that have been listed in Table 1 were given prophylactic antibiotics but postoperative regime, type of prosthesis (whether cemented or uncemented), and surgical and operating environment did vary.

\textsuperscript{1}13.5\% infection occurred in the group who did not receive cefuroxime-impregnated cement.

\textsuperscript{2}Average preoperative KSS score of both D and ND.

\textsuperscript{3}A randomised single-blinded trial evaluating the role of cefuroxime-impregnated cement in diabetic patients undergoing TKA.
cement in only 12% of patients. Other studies did not report whether or not they used antibiotics in their cement. \textsuperscript{24–26} That said, most studies have shown an increased deep infection rate, \textsuperscript{22,23,25–27} so it is important to take all necessary precautions, including the routine use of prophylactic intravenous antibiotics, clean air theatres, good surgical technique and antibiotic-loaded cement, to minimize the risk in this group of patients.

Looking at the five studies of knee replacement in diabetics \textsuperscript{22–27} together, there were 627 patients. Of these 469 (75\%) patients were NIDDM while 158 (25\%) were IDDM. Deep infections occurred in both groups. There were a total of 23 deep infections, 17 NIDDM (73.9\%) and 6 IDDM (26.1\%). No correlation between deep infection and diabetic subtype has been reported so far (Table 1).

**Outcome scores**

The Hospital for Special Surgery (HSS) knee score \textsuperscript{36} and the Knee Society score (KSS) \textsuperscript{37} are commonly used to measure outcome of TKA (Tables 2 and 3). A HSS score of 85–100 points represents an excellent result, 70–84 points a good result, 60–69 points a fair result and <60 points a poor result.

The KSS goes further, stratifying patients into 1 of 3 categories depending on their overall musculoskeletal status. Patients in group A have unilateral knee symptoms or the other knee successfully replaced, group B patients have bilateral symptoms and group C have multiple joints affected or medical infirmity. Separate scores are obtained for pain and function to permit better assessment of both specific prosthetic knee function and overall functional status of the patient. England et al. \textsuperscript{26} Introduced an arbitrary score of 50 for pain and 40 for function in those TKAs that failed (for whatever reason) and these patients were still placed in their most appropriate categories. This allows for failed knees to be penalized at time of assessment but at the same time does not have the disproportionate downward effect on average scores (especially if assessing a small number of knees). He argued that failed knees could be minimally painful and have adequate residual function.

In the studies that reported HSS scores \textsuperscript{22,24–26} there were significant improvements in the HSS score postoperatively. Averaging the four studies the preoperative HSS score was 51 points and postoperative HSS score 83 points. Of those studies which reported percentages of their patients in the relative groups \textsuperscript{24–26} 81\% of the TKAs were rated excellent or good, 9\% rate-fair and 10\% rated poor (Serna et al. \textsuperscript{25} scored his knees at 90–100 points as excellent, 80–89 as good, 70–79 as fair and <70 as poor which may explain why they had a higher percentage of poor outcomes).

The postoperative HSS scores in diabetics were found to be significantly lower in 2 studies: Pagagelopoulos et al. \textsuperscript{24} reported a postoperative KSS score of 77 in diabetics and 86 in the matched

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**Table 2** The hospital for special surgery (HSS) knee scoring system.

<table>
<thead>
<tr>
<th>Pain</th>
<th>Function</th>
<th>Range of motion</th>
<th>Muscle strength</th>
<th>Instability</th>
<th>Flexion deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score (Total 104)*</td>
<td>Max 30</td>
<td>Max 22</td>
<td>Max 22</td>
<td>Max 10</td>
<td>Max 10</td>
</tr>
</tbody>
</table>

*In addition there are subtractions for use of walking aids, extensor lag and residual deformity (Max penalty being 5 points). The maximum amount that can be awarded is 100 points.

**Table 3** The knee society scoring (KSS) system.

<table>
<thead>
<tr>
<th>Knee score</th>
<th>Function score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>Range of motion</td>
</tr>
<tr>
<td>Score (max)</td>
<td>50</td>
</tr>
<tr>
<td>Total (max)</td>
<td>100</td>
</tr>
<tr>
<td>Deductions</td>
<td>Flexion contracture, extension lag &amp; malalignment</td>
</tr>
</tbody>
</table>

In addition the patients are divided into 3 separate categories.

**Patient Category:**

A. Unilateral symptoms (including other side successfully replaced).

B. Bilateral knee symptoms.

C. Multiple joints affected or medical infirmity.

If total is a minus score, score is 0.
control ($P<0.05$); Serna et al.\textsuperscript{25} reported an average postoperative HSS score of 85 in diabetics and 92 in the matched control group which was significant ($P<0.01$). There were no statistically significant differences in the HSS scores with regard to various diagnoses, cement vs uncemented fixation, preoperative deformity and number of prior surgical procedures, in the same study.\textsuperscript{25}

In the studies that reported KSS there were similar improvements.\textsuperscript{22,24,26,27} The average preoperative knee scores from the 5 studies improved from 43 points to an average postoperative score of 82 points. Meding et al.\textsuperscript{27} found that the diabetic patients had a higher preoperative knee score, possibly due to diabetic patients having a subclinical or clinical neuropathy with a loss of pain perception. The postoperative improvement in the knee scores was similar for their diabetic and non-diabetic patients (Table 1). As expected knee function scores were lower in diabetic patients both pre and postoperatively. Scores were even lower in patients with insulin-dependent diabetes (Table 1). Despite this, however, the average preoperative function scores improved form 43 points to an average postoperative function score of 66 points.

### Stiff knees

Meding et al.\textsuperscript{27} showed no difference in the manipulation under anaesthetic rates in their diabetics and non-diabetic groups (91.2% in both groups).

### Aseptic loosening

In diabetes mellitus, sensory and autonomic neuropathy may occur even at subclinical levels.\textsuperscript{38} Loss of sensation, proprioception and pain perception could lead to increased risk of aseptic loosening. Revision for aseptic loosening of TKAs does seem to be higher in diabetics. The three studies that included matched control groups\textsuperscript{24,25,27} all reported higher rates of revision, although only two reported this to be significant.\textsuperscript{25,27} Meding et al.\textsuperscript{27} reported revision rates for aseptic loosening, of 3.6% in diabetics vs 0.4% in the matched control group ($P<0.05$). Similarly Serna et al.\textsuperscript{25} reported a revision rate of 7% in diabetics and 1.9% in the matched control group ($P<0.001$).

Pagagelopoulos et al.\textsuperscript{24} also reported an increase of progressive radiolucencies and aseptic loosening on radiographic evaluation compared to the matched control group (7.4% vs 3%) but this difference was reported as not significant.

### Survivorship

Two studies addressed the long-term survivorship of the prosthesis using the Kaplan–Meier survivorship analysis. Patients who underwent revision surgery or those advised to have revision were considered implant failures. Pagagelopoulos et al.\textsuperscript{24} reported that the probability of implant survival was 95% at 5 years and 91% at 10 years. There was no significant difference between the diabetics and the matched control. Similarly Meding et al.\textsuperscript{27} reported a figure of 98% at 7 years with no significant difference between diabetics and non-diabetics. Furthermore when IDDM and NIDDM patients were compared, again there was no significant difference reported. They also were unable to establish an association between implant survival and patient age at surgery, type of diabetes presence of systemic complications of diabetes, bilateral arthroplasty or underlying diagnoses. Men had a reduced probability of implant survival at 10 years (84%) than women (97%). Increased weight and previous operations were the only other risk factors for a decreased probability of implant survival with figures of 64% (compared with 98%) and 85% (compared to 97%) at 10 years, respectively.

### Uncemented TKR

Only one study looked at the uncemented TKA in diabetic patients.\textsuperscript{24} It found no difference in the appearance of radiolucencies or rate of aseptic loosening within this subgroup, which comprised 57% of the study population. Studies have demonstrated defects in fracture healing in experimental diabetes (related to bone ingrowth), which gives a theoretical increased risk of early failure in uncemented total knee arthroplasty. Despite no reported increase in the rate of aseptic loosening in this series, we would be cautious in advising the use of uncemented TKAs in diabetics when cemented TKAs have proven long term results.

### Medical complications

#### Urinary tract infection (UTI).

Reported rates of UTI in diabetics during the perioperative phase after TKA range from 1.2% to 15%.\textsuperscript{23,25,27} Yang et al.\textsuperscript{23} reported a significant correlation between development of symptomatic UTI between catheterized and non-catheterized patients, the risk of UTI being 35% and 9%, respectively. The risk of UTI also increased with duration of catheterization. Only one patient in this study with a UTI went on to develop a deep infection in the knee joint, thought to be unrelated.

In a separate study looking at urinary complications in non-diabetic elderly females undergoing THA, Carpiniello et al.\textsuperscript{39} reported that routine
perioperative catheterization can reduce the risk of UTI form 16% to 4%. Although it is obviously desirable to try and minimize the risk of UTI, no study to date has established a relationship between symptomatic UTI and the development of deep joint infection. A pragmatic approach should be taken, and the threshold for elective catheterization at time of surgery should be low especially if there has been a previous history of urinary tract problems or anticipated longer immobility post surgery and removed as soon as it is feasible.

**Deep vein thrombosis (DVT).** Reported rates of DVT varied from 0% to 54%. There were no reported cases of pulmonary embolus. Pagagelopoulos et al. had reported no cases of DVT and Yang et al. reported only 1 case of DVT (1%) but routine ultrasonography or venography was not performed in these studies. Only those suspected clinically of DVT were investigated using ultrasonography. In contrast England et al. was the only study to routinely perform venograms on all their patients (on the 5th postoperative day) and found a DVT rate of 54% with no reported cases of PE using only postoperative aspirin as prophylaxis. They did not report any difference in rate of DVT between IDDM and NIDDM. This rate of DVT is comparable to other TKA studies.

**Neuropathy.** Meding et al. found a significantly higher neuropathy rate in the diabetic group. Serna et al. also found 9% of there cases had a post operative neuropathy.

**Cardiovascular and gastro-intestinal.** Meding et al. showed that the stoke rate, myocardial infarction rate and the gastrointestinal complications were no different in their diabetic group compared to the non diabetic patients.

**References**


Available online at www.sciencedirect.com