

# Team Approach for Diabetic Foot Problems

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## INTRODUCTION

The prevalence of diabetes is very high in countries in the region. In Singapore, it is about 8.2% in 2004<sup>1</sup>. However, in the fifth and sixth decades of life – the age group in which diabetics commonly present with diabetic foot problems, the incidence is as high as 16.7% and 28.7% respectively<sup>1</sup>. In addition, we must recognize the high incidence of newly diagnosed diabetes - 49.4%<sup>1</sup>.

About 20-40% of all diabetics develop sensory neuropathy<sup>2,3,4,5</sup>. About 5-7% of all diabetics develop foot ulceration<sup>3,4,6,7</sup>. Foot ulcers commonly become infected, may develop gangrene and result in major lower limb amputation (below knee or above knee amputation). In National University Hospital (NUH), diabetic foot problems accounted for 20% of all emergency admissions<sup>5</sup>. The major amputation rate was about 27%. In Singapore, annually diabetes is responsible for 200 lower extremity amputations<sup>8</sup>. Indeed this is a global problem. A lower limb is lost to diabetes every 30 seconds<sup>9</sup>. Whilst loss of limb is not only a big emotional burden to patient and family and also reduce the quality of life, the mortality associated with amputation is often not well recognized. It must be emphasized that the mortality rate is about 10% at the time of amputation, 30% within one year and as high as 70% within 5 years<sup>9</sup>. It must therefore be realized that major amputation leads to loss of life. The ultimate goal in the management of diabetics with diabetic foot problems is therefore to prevent loss of limb or reduce the major amputation rate.

## Need for Diabetic Foot Service

Currently with subspecialty development in Orthopaedic Surgery, the care of diabetic foot is not part of any subspecialty. Subspecialties developed involved spine, joint arthroplasty, adult reconstruction, sports medicine, knee, hip, shoulder, ankle and foot surgery, oncology, paediatrics and trauma. Even the ankle and foot specialists are not keen to provide a diabetic foot service. Indeed, the care and surgery of diabetics with foot problems are often left to Orthopaedic Registrars. Most operations are done as emergencies by Registrars or Medical Officers on duty. It is therefore not surprising that currently, the morbidity and mortality rates

for patients with diabetic foot problems are high. They have a long average length of stay, incur high hospitalization costs and result in a high incidence of major amputations.

## Nature of Diabetic Foot Problems

In caring of diabetics with DFP one must note that the pathogenesis of DFP include neuropathy, vasculopathy and immunopathy. Neuropathy includes sensory neuropathy, motor neuropathy and autonomic neuropathy. Vasculopathy is mainly due to peripheral vascular disease and immunopathy due to deranged function of leukocytes in diabetics.

## Modes of Presentation

Diabetic Foot Problems could present as Cellulitis, Abscess, Osteomyelitis, Septic Arthritis, Dry Gangrene, Wet Gangrene, Ulcer, Charcot Joint Disease and Necrotising Fasciitis.

## Classification

Diabetic Foot Problems are best classified according to King's Classification<sup>10</sup>.

- Stage 1: Normal
- Stage 2: High Risk
- Stage 3: Ulcerated
- Stage 4: Cellulitic Stage
- Stage 5: Necrotic
- Stage 6: Major Amputation

## Factors Predisposing for Limb Loss

There are several factors that predispose the diabetic foot to loss of limb. Nather *et al* 2007<sup>5</sup> showed that significant univariate factors for limb loss included age above 60 years, presence of stroke or ischaemic heart disease, diabetic nephropathy, peripheral vascular disease, sensory neuropathy, GHb level, (diabetic control), ABL < 0.8, gangrene, infection, MRSA and Staphylococcus aureus. Upon multivariate analysis, peripheral vascular disease and infection were significant.

## Need for a Multi-Disciplinary Team Approach

Having understood the nature of diabetic foot problems, its pathogenesis, modes of clinical presentation and the myriad

of factors involved to prevent loss of limb, it is easier to understand that the comprehensive care of a diabetic foot requires the service of an endocrinologist, a infectious disease specialist, a vascular surgeon, an orthopaedic surgeon, a podiatrist and nurses specialized in wound care, foot care and education for diabetes as well as other allied health professionals including counsellors, dietitian and rehabilitation specialists working together as a team of specialists.

Frykberg<sup>11</sup> showed that a multi-disciplinary team approach for managing DFP improved significantly the outcome of patients with DFP. This has also been shown by several other workers – Caputo, Cavanagh, Ulbrecht, Gibbons and Karchmer, 1994<sup>12</sup>; Caputo, Joshi and Weitekamp, 1997<sup>13</sup>; Edmonds *et al*, 1986<sup>14</sup>; Frykberg, 1998(a)<sup>15</sup>; Frykberg, 1988(b)<sup>16</sup>; Frykberg *et al*, 2006<sup>17</sup>; Rosenblum *et al*, 1994<sup>18</sup>.

### Implementation of a Clinical Pathway

In addition to the formation of a multi-disciplinary team by a team of specialists, Martinez *et al*, 2004<sup>19</sup> showed that the implementation of a clinical pathway was instrumental to the high quality of services that could be provided to the patient.

The NUH Multi-Disciplinary Team for DFP was formed in May 2003 by the author. The team including an endocrinologist, infectious disease specialist, vascular surgeon, podiatrists, nurses trained for wound care, nurses trained for education on diabetes, counsellors and other allied health professionals. The team conducted weekly ward rounds covering all patients with DFP admitted to NUH and also a “Diabetic Foot Team Clinic” every Wednesday namely with an orthopaedic surgeon (author), endocrinologist and podiatrist. In addition to formation of the team, a strategic development on diabetic foot service provided was the implementation of a clinical pathway for DFP.

Following the formation of this team and implementing our clinical pathway, the average length of stay was reduced from 20.4 days in 2002 (pre-team formation) to 4 days in 2004 (post-team formation though the difference was not statistically significant ( $p=0.212$ ). The hospitalization cost

per patient was reduced from SGD\$8,847 in 2002 to SGD\$7,660 in 2004 (not statistically significant –  $p=0.651$ ) The major amputation rate was however significantly reduced from 31% in 2002 to 20% in 2004 ( $p=0.022$ )<sup>5</sup>.

Faglia *et al*, 1998<sup>20</sup> also showed that the formation of a ‘foot team’ running a ‘foot clinic’ reduced the major amputation rate from 40.5% to 23.5%. Driver *et al*, 2005<sup>21</sup> showed that the formation of a ‘specialized foot care clinic’ decreased the rate of amputation dramatically from 9.9 per 1000 to 1.8 per 1000 over 5 years. Other teams likewise showed a significant reduction in the incidence of major amputations with a 78% decrease in major amputation rate by Larsson *et al*, 1995<sup>22</sup> and with a 50% decrease in major amputation rate by Apelqvist and Larsson, 2000<sup>23</sup>; Van Damne *et al*, 2005<sup>24</sup>; and by Levin, 1996<sup>25</sup>, and with a 47.4% decrease in major amputation rate by Lavery *et al*, 2005<sup>26</sup>.

### CONCLUSIONS

The author would urge hospitals in the region to set up multi-disciplinary teams for managing diabetic foot problems to provide a better and cost-effective diabetic foot service to reduce average length of stay, hospitalization cost per patient, re-admission rate and major amputation rate. It must be emphasized that a strategic tool to bring this change in addition to forming a team of specialists is to implement a good clinical pathway for management patients with diabetic foot problems.

### ACKNOWLEDGEMENT

I would like to thank members of the National University Hospital, Multi-disciplinary team for diabetic foot problems for their support – Dr Chionh Siok Bee, Endocrinologist, Associate Professor Paul Tambyah, Infectious Disease Specialists, Dr Peter Robless, Vascular Surgeon, Mr Adriasn Erasmus, Principal Podiatrist, Mr Ronnie, Case Manager and other allied health professionals. I would also like to thank Ms Jamaliah Baharim for the secretarial assistance provided.

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