

Comparing diabetes mellitus care in a major city in China to a major city in South East Asia



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ABSTRACT

Aim: There is a worldwide increasing prevalence of diabetes mellitus. Although everyone has the same aim to achieve good glycaemic control, diabetes mellitus care is largely variable across the world. Diabetes mellitus care imposes a significant economic burden on the national healthcare system. Inpatient care accounts for the bulk of healthcare cost for patients with diabetes mellitus and these patients have an increased risk of recurrent hospitalizations. There is a need to seek continual improvement in our care for diabetes mellitus and there is much to learn from best practices in various countries. Medical exchange programs are useful for identifying similarities and differences between institutions and allow adaptation of good medical practices.

Methods: This is a descriptive, cross-sectional study comparing diabetes mellitus care in two tertiary hospitals, one in Shanghai, China and the other in Singapore. Comparisons are based on independent observations and interviews with medical doctors during a medical exchange program in September 2016.

Results: There was stark difference in the inpatient diabetes mellitus care. In Shanghai, subcutaneous continuous insulin infusion therapy, continuous glucose monitoring (CGM) and eight-point capillary glucose level checks were routinely used for inpatient glycaemic control. However, in Singapore, subcutaneous continuous insulin infusion therapy and CGM are used mainly in the outpatient setting.

Conclusion: Compared to basal-bolus insulin regimens, subcutaneous continuous insulin infusion therapy would best mimic endogenous insulin secretion. However, its use for inpatient glycaemic control still lacks conclusive evidence about benefits and safety, and should be evaluated on a larger scale.

Introduction

Congruent with the worldwide increasing prevalence of diabetes mellitus, the prevalence of diabetes mellitus in China and Singapore have increased from previous years and currently stands at 9.7% and 12.6% respectively [1,2]. As of 2016, the population in Shanghai was 24 million and the population in Singapore was 5.6 million, with a corresponding physician to population ratio of 36.5 physicians per 10,000-population in urban Shanghai, and 23 physicians per 10,000-population in Singapore

[3,4]. Both countries spend a similar proportion of their gross domestic product (GDP) on healthcare, with China spending 5.5% and Singapore spending 4.9% [5]. Diabetes mellitus care accounts for 6% and 10% of total healthcare expenditure in China and Singapore respectively [6,7]. In both countries, approximately 1.7% to 2% of hospitalisations are due to diabetes mellitus [2,8]. Despite the same glycaemic targets, diabetes mellitus management in Singapore and China remains largely different.

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KEYWORDS

- diabetes mellitus
- hospitalized patient's
- insulin pump
- continuous glucose monitor
- inpatient glycemic control
- subcutaneous continuous insulin infusion

Methods

This is a descriptive, cross-sectional study comparing the medical practice in a large tertiary hospital in Shanghai, China to a large tertiary hospital in Singapore. A medical exchange program allowed one endocrinologist from Singapore to visit a large tertiary hospital in Shanghai, for one week in September 2016. Independent observations were made for both inpatient and outpatient endocrinology care during the medical exchange program. The specific focus of this paper centres on inpatient diabetes mellitus care, based on clinical observations and interviews with medical doctors, supplemented with relevant literature review.

Outcomes

For both tertiary centres, patients with diabetes mellitus, in particular type two diabetes mellitus, accounted for majority of patients admitted to the Endocrinology Service. In the Shanghai centre, there was a dedicated endocrinology ward with 48 beds available. In the Singapore centre, patients admitted to the endocrinology service do not get admitted to a dedicated ward. For inpatient care, the approximate patient to endocrinologist ratio was comparable for both centres-6 in Shanghai and 4 in Singapore. The most striking difference in diabetes mellitus care between the two centres was in their inpatient glycaemic management.

There had been great emphasis on the importance of good inpatient glycaemic control because hyperglycaemia and hypoglycaemia can potentially increase the length of stay, morbidity and mortality [9,11]. During hospitalisation, various factors such as stress- or illness-related hyperglycaemia, unpredictability of caloric intake, or changes in schedule for procedures requiring fasting, make glycaemic control challenging. With so much variability, insulin therapy often allows better glycaemic control than oral glucose lowering drugs (OGLDs). Therefore, most hospitalised patients would benefit from insulin therapy. Commonly prescribed insulin therapy regimens include subcutaneous basal-bolus insulin or intravenous insulin infusion. Patients who were previously on OGLDs should have their OGLDs restarted at least one to two days before discharge [12].

In Shanghai, when patients with diabetes mellitus are admitted to the endocrinology service,

subcutaneous continuous insulin infusion therapy via an insulin pump will be initiated. The insulin basal rates would be calculated based on patients' body weight, according to a standardised insulin chart. These patients will also have their glucose levels monitored by eight-point capillary blood glucose level checks (pre-meals, 2 hours post-meals, bedtime and 3 am), in conjunction with Continuous Glucose Monitoring (CGM) for three days. Selected nurses in the endocrinology ward have been trained in operating the insulin pumps and CGM devices from one company. During the hospital stay, insulin pumps and CGM devices would be managed by these trained nurses. Once fit for discharge, most patients would be given a prescription for OGLDs or subcutaneous insulin. This is because the upfront costs of insulin pumps and CGM devices are very high and fully payable by patients, and are not commonly used in the outpatient setting. This is in contrast to the inpatient setting, where charges for insulin pump and CGM devices are heavily subsidised.

In Singapore, hospitalised patients with diabetes mellitus are typically maintained on their usual medications, with the dosages adjusted as appropriate. Patients who require fasting would have insulin therapy initiated based on a nil-by-mouth protocol, where basal and correctional insulin would be ordered. For patients who require stricter glycaemic control, such as in those who are critically ill, intravenous insulin infusion therapy would be initiated. For most patients, glycaemic control is assessed by four-point capillary blood glucose level checks (pre-meals and bedtime). Post-meal capillary glucose level checks are only performed for pregnant patients with diabetes mellitus. In Singapore, insulin pump therapy and CGM are mainly used in the outpatient setting, and used more for patients with type I diabetes mellitus.

Discussion

Continuous subcutaneous insulin infusion via an insulin pump represents a flexible means of precise insulin delivery. In several studies, insulin pump therapy, when compared to Multiple Daily Insulin (MDI) injection therapy, had been shown to improve glycaemic control for patients with type I diabetes mellitus, with reduced hypoglycaemia rates and lower total insulin dosages [13]. It is also widely accepted that insulin pump therapy is beneficial for patients with frequent hypoglycaemia or hypoglycaemic

unawareness. In the recent years, insulin pump therapy use has increased, with about 1 million insulin pump users worldwide. However, since insulin pump therapy is significantly more expensive than MDI therapy, insulin pump therapy is commonly not reimbursable or subsidized by many insurance or healthcare systems. In most countries, insulin pump therapy remains to be used predominantly in the outpatient setting, for patients who are able to afford the upfront costs.

In many Chinese hospitals, insulin pump therapy is commonly used for inpatient glycaemic control [14]. In the China insulin pump therapy guidelines published in 2010, indications for short-term insulin pump therapy included: i) Hospitalised patients with type I or type II diabetes mellitus requiring intensified insulin treatment, ii) Type II diabetes mellitus patients requiring short-term insulin treatment to control blood glucose levels, iii) During perioperative period in patients with diabetes mellitus, and iv) Pregnant women with diabetes mellitus [15]. Some Chinese investigators found that insulin pump therapy could achieve favourable glycaemic control with reduced hospital length of stay, while being associated with a reduced hypoglycaemia risk and better post-operative recovery [16,17].

The use of insulin pump therapy for inpatient glycaemic control is not widely practiced in other parts of the world. In fact, there are several publications addressing the difficulties in continuing to use insulin pumps in the inpatient setting, when pre-existing insulin pump users get hospitalised [14,18]. Some cited reasons include: i) Lack of familiarity of medical personnel with the wide range of insulin pumps available, ii) Issues with reliability and accountability if insulin pumps are controlled by patients or their close family members, and iii) Risks of pump malfunction-such as infusion catheter kinks or radiation-induced pump malfunction [16,19]. Most importantly, there is still lack of conclusive evidence about the cost-effectiveness and benefits of insulin pump therapy on glycaemic homeostasis in hospitalised patients. The Shanghai centre circumvented some of the cited difficulties by standardising the insulin pumps available, and by ensuring that a few selected endocrinology ward nurses are trained in the operation of insulin pumps.

The US FDA approved the use of CGM as an adjunct to current intermittent capillary

glucose monitoring. CGM allows continuous measurement of interstitial fluid glucose levels and provides significant information such as glycaemic variability and hypoglycaemic episodes in patients with hypoglycaemia unawareness. Currently, it is mainly recommended for use in the outpatient setting. CGM use in hospitalised adult patients is not recommended, especially for patients in critical care and operating theatres [20]. In the recent International hospital diabetes meeting, the expert consensus was that the use of CGM for hospitalised patients has many potential advantages, but there is insufficient outcome data to support widespread use. Since CGM is expensive in many countries, careful patient selection will be necessary to ensure a cost-effective practice. Most centres perform capillary blood glucose monitoring before meals and at bedtime for non-critically ill patients who are hospitalised, with increased monitoring for a select group such as critically ill patients or pregnant patients. Since capillary glucose checks are costly, the frequency of capillary glucose checks should be carefully balanced with cost-effectiveness and patient requirements.

Conclusion

Diabetes mellitus care is as much an art as science, and it is important to have a global view and open mind-set to learn best practices from various institutions around the world. With the worldwide increasing prevalence of diabetes mellitus, it is pertinent to improve our model of care for diabetes mellitus. This medical exchange program allowed identification of the vast differences in inpatient glycaemic care between not just the tertiary hospitals in Shanghai and Singapore, but also between Shanghai and the rest of the world. Since insulin pump therapy would best mimic endogenous insulin secretion, it would certainly be worthwhile to evaluate the use of insulin pump therapy for inpatient glycaemic care on a larger scale. However, the use of CGM and eight-point capillary glucose monitoring for all patients, would need to be assessed carefully for cost-effectiveness.

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