Nursing workload and perception about intensive insulin therapy in critically ill adult patients

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Stress hyperglycemia is common in critically ill patients, as a manifestation of insulin resistance.[1] One randomized controlled trial (RCT) showed that intensive insulin therapy (IIT) to tightly control blood glucose improved the outcomes of surgical critically ill patients[1] although several subsequent RCTs did not demonstrate such benefit. Intensive insulin therapy involves frequent monitoring of blood glucose levels and the use of intravenous (IV) insulin infusion, which is performed by intensive care unit (ICU) nurses, who do many additional tasks related to patient care. Theoretically, any extra task will increase their workload and may indirectly affect patient care. The objectives of this study were to assess nursing workload related to IIT and to study the nurses' perception of IIT in relation to total patient care and outcome.

This was an observational study conducted at the 21-bed adult ICU of King Abdulaziz Medical City in Riyadh, Saudi Arabia from November 2007 to February 2008. A trial comparing IIT with conventional insulin therapy was previously conducted in this unit. The nurses were specialized in critical care and had managed patients on IIT protocol. They worked 12-hour shifts with nurse to patient ratio of 1:1. According to the IIT protocol, the blood glucose level was monitored hourly to adjust insulin infusion rate to keep blood glucose level between 4.4-6.1 mmol per liter. This study was approved by the hospital research committee and involved 2 components. In the first component, the investigator obtained verbal consent from the nurses who were observed during blood glucose measurement and IV insulin infusion adjustment and used a stopwatch to measure the time taken by each nurse to perform this procedure. The starting point was when the nurse gathered all the equipments to start the procedure and the endpoint was when he/she documented the result of blood glucose level and the insulin dose adjustment if it was carried out. We documented the steps performed during each observation and recorded the source of blood sample (capillary, arterial, or venous blood sample). The AccuChek Inform (Roche, Mannheim, Germany) glucometer was used for blood glucose measurement. Thirty observations were made. Because more time might be required for patients who were in the isolation rooms, thus, we also documented their isolation status. The second part consisted of a questionnaire, which was formulated after literature review and discussion with one of the ICU clinical resource nurses. The questionnaire was introduced with a statement of the study purpose and that the participation was voluntary. It included 3 sections: 1) demographic information and work experience, 2) nurses' perception of IIT using 14 statements with the response to these statements based on a 5-point Likert scale (strongly agree, agree, neutral, disagree, or strongly disagree), and 3) open ended comments on IIT and its protocol. The ICU charge nurses distributed the questionnaires to the nurses during their usual daily work and gathered them when completed. We used SPSS program version 15.0 to analyze the data. Continuous variables were presented as a mean and standard deviation (SD). The categorical variables were presented as frequencies and percentages.

The mean time for performing glucose measurement and insulin dose adjustment was 3.9 ± 0.9 minutes (range: 1.8-5.7 minutes). By extrapolation, IIT protocol application required on average 46.8 ± 10.8 minutes per 12-hour nursing shift. Nine observations were from isolated patients, which required an extra step of gowning. Four blood samples were taken by fingerstick and 26 blood samples from arterial lines. In the questionnaire part, we distributed 120 forms to the adult ICU nurses, 61 nurses completed the questionnaire forms with a 50.8% response rate. **Table 1** describes the main findings. Most nurses (82%) thought that they got enough education and training on how to implement IIT protocol and 80% believed that the insulin infusion protocol was easy to understand and follow. Most nurses (79%) thought that keeping blood glucose level in the normal range improved patients' outcome, however, 59% believed that hourly blood glucose measurement for glycemic control was too much work. Sixty-six percent agreed that automated blood glucose reading would make glycemic control easier. Seventy-two percent preferred to take arterial or venous rather than capillary blood sample and 46% thought that the source of blood sample did not affect blood glucose level. Fifteen nurses suggested additional comments. Examples of these comments are: IIT is too much work and frustrating; fingerstick is a traumatizing and unpleasant way to obtain blood sample; IIT is not needed for many patients as they are not diabetics or have poor prognosis; IIT is harmful to some patients because it can lead to frequent hypoglycemia; and IIT should be carried out every 4 hours instead of doing it hourly regardless of the patient's condition'.

In summary, we found that IIT consumed a considerable time of nursing care and required significant effort, which would increase nursing workload in general as ICU nurses usually perform several tasks related to patient care in addition to the bedside blood glucose measurement. Despite that, we

Table 1 - Questionnaire on the intensive care nurses' perceptions of intensive insulin therapy in critically ill adult patients (n = 61).

Statements	Agreement*		Neutral		Disagreement*	
	n	(%)	n	(%)	n	(%)
I know about the insulin therapy study that was carried out in this unit	55	(90.2)	2	(3.3)	4	(6.6)
I have a good knowledge of the selection/exclusion criteria for the insulin therapy study	41	(67.2)	15	(24.6)	5	(8.2)
I got enough education and training of how to implement IV insulin protocol	50	(82.0)	6	(9.8)	5	(8.2)
The IV insulin infusion protocol (conventional or intensive) is easy to understand and follow	49	(80.3)	6	(9.8)	6	(9.8)
I understand why the insulin therapy study was carried out	40	(65.6)	11	(18)	10	(16.4)
Keeping blood glucose levels in the normal range improve patient's outcome	48	(78.7)	7	(11.5)	6	(9.8)
Blood glucose level should be checked hourly for all patients on continuous IV insulin	29	(47.5)	8	(13.1)	24	(39.3)
Hourly measurement of blood glucose level for glycemic control is too much work	36	(59)	8	(13.1)	17	(27.9)
It takes a lot of my time to do hourly blood glucose levels as required by the study	34	(55.7)	11	(18.0)	16	(26.2)
Hourly blood glucose measurements delay doing other nursing jobs	32	(52.5)	11	(18.0)	18	(29.5)
A patient in the conventional group whose blood glucose level is unstable requires the same amount of work as a stable patient in the intensive group	36	(59.0)	8	(13.1)	17	(27.9)
Source of blood sample (fingerstick/arterial line/venous line) doesn't affect blood glucose level	28	(45.9)	13	(21.3)	20	(32.8)
I prefer blood glucose measurement by taking blood from arterial/venous line rather than fingerstick	44	(72.1)	13	(21.3)	4	(6.6)
If I had an automated way to get blood glucose reading, it would make glycemic control easier	40	(65.6)	16	(26.2)	5	(8.2)

This questionnaire was based on 5-points Likert scale. Surveyed nurses responded as strongly agree, agree, neutral, disagree, or strongly disagree to each statement. *In this table, we combined strongly agree and agree into agreement, and disagree and strongly disagree into disagreement. IV - intravenously

observed a general acceptance of carrying out IIT to tightly control blood glucose and ICU nurses thought that IIT would improve the outcome of critically ill patients, based on the best evidence available at the time of the study. Generally, our findings are close to those of earlier studies,[2,3] with only minor differences. Although many physicians consider it to be a straightforward procedure, IIT entails a complex process that requires multiple steps and carries increased risk of complications such as hypoglycemia.[4] Interestingly, the majority (80%) of surveyed nurses found IIT protocol easy to understand and follow. This is likely due to the fact that they received substantial education on IIT protocol as they participated in an RCT that compared IIT to conventional insulin therapy. Without such education, IIT implementation might become more hazardous to patients. Another interesting finding is that nurses avoided obtaining blood from fingerstick for blood glucose measurement, likely because they thought that deed to be traumatizing or less convenient. Obtaining blood from different sources can result in aberrancies in blood glucose measurements as evidence suggests that the source of blood samples does affect the blood glucose level.[5] Hence, blood source should be taken into consideration when interpreting blood glucose levels in critically ill patients.[5] Education of nursing and medical staff on this important issue is needed.

In conclusion, IIT was associated with significant increase in nursing workload in the ICU. This was too much work for most of nurses. Despite that, most ICU nurses believed that IIT was beneficial to patients. They hoped for an easier way for blood glucose measurement and control such as the use of continuous blood glucose measuring devices and computerized intravenous insulin infusion programs. Education on insulin protocols and blood glucose measurements is needed to reduce complications related to insulin therapy.

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