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Review Article

INTRAOPERATIVE MANAGEMENT OF DIABETES BY ANAESTHETOLOGISTS COMPARED TO INTERNISTS

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Abstract:

BACKGROUND: Surgery in patients with diabetes mellitus (DM) has increased morbidity and mortality. Preoperative management guidelines are extensive starting days before surgery. However' the main intraoperative task lies on anaesthetologists rather than internists. **OBJECTIVES:** to explore knowledge, attitude and practice of physicians towards intraoperative management of DM and to compare between anaesthetologists and internists. **METHODS:** This cross-sectional study included 100 physicians (57% females & 43 % males) from governmental (73%) and private (27%) hospitals in Jeddah, Saudi Arabia. From August to November 2018, participants received through e-mails a self-answered questionnaire consisting of 13 questions on intra-operative management of DM. Poor practice was decided if right answer was < 60% or total score < 8 (out of 17). **RESULTS:** participants' median age was 30.0 (23.0-60.0) years with 5.0 years (1.0-35.0) median period of experience. Their median total score was accepted (8) and was positively associated with duration of experience ($r=0.263$, $p=0.008$) but not the professional groups ($p=0.447$). Anaesthetologists had increased odds of low scores compared to internists (OR 2.62 (95% CI: 1.16-5.92), $p=0.011$); however, they were equally satisfied by their practice ($p=0.402$). Their main defects were the duration of fasting (16%), timing of glucose monitoring (44%), indications for postponing surgery (38%), factors guiding management (58%), how to use variable rate insulin infusion (VRII), (52%), when to postpone surgery, (38%) and what guide intraoperative management (58%). **CONCLUSION:** physicians were satisfied by their KAP concerning intraoperative DM management; however, they had many defects. There is a need to improve implementation of recent guidelines especially among anaesthetologists. New guidelines should focus on intraoperative management and to direct their clear recommendation to the anaesthetists.

Key words: intraoperative, diabetes mellitus, elective surgery, anaesthetologists, internists.

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INTRODUCTION:

Surgical patients with hyperglycemia or diabetes mellitus has significantly increased peri-operative morbidity and mortality compared to non-diabetic patients (1) especially among patients with hypoglycemia (1), uncontrolled hyperglycemia (1), and microvascular and macrovascular complications (2). Physicians are usually confronted with the complexity of preoperative preparation of these patients which starts days before surgery. The most common reported problems related to physicians's managemnts of surgical patients with diabetes include insulin prescribing errors (3-5) and in particular; the inadequate application of guidelines for perioperative management of diabetes (1,6,7).

Internists are ususally consulted early for perioapive aassessment and magement. Surgeons usually carried the immediate postoperative care for their patients including hyperglycemic management untill patients return to their normal diet and usual diabetes regimen (8,9). While the intra-operative care of hyper and hypoglycemia and the flfluid managent are usually provided by anaesthetologists to maintain hemodynamic stability and glycaemic control while optimising their usual duties. They should check capillary blood glucose (CBG) before induction of anaesthesia and then monitored regularly during the procedure at least hourly. The accepted intra-operative CBG is in the range of 108-180 mg/dl (6–10 mmol.l⁻¹) with an upper limit of 216 mg/dl (12 mmol.l⁻¹) depending on the state of diabetes control and the use of variable rate intravenous insulin infusin (VRIII). Therefore the aims of this study were to explore knowledge, attitude and practice (KAP) of physicians towards intraoperative management of DM on the day of surgery and to compare between internists and Surgeons/anaesthesiologists. questions refrence

METHODS:

This cross-sectional study was carried out in both governmental and private hospitals from August to September 2018. A self-answered questionnaire was sent through e-mails to 100 physicians from internal medicine and anaesthesia department. They included consultants, specialists, and residents. The

participants were asked their consent to self-answer the questionnaire independently. A questionnaire was constructured comprising 14 questions to measure the participants' KAP regarding management of patients with known diabetes during the day of surgery. The first section of the questionnaire consisted of demographic data, field of specialization, period of experience, specialities, job title, job satisfaction. In addition, there was one question about who is the responsible physician for peroperative management. The second part of the questionnaire included 12 single-answer questions and 2 multiple-choice questions. The questionnair was designed based on the recommendation published guidelines (8,9), physicans had enough time to follow the recommendation more than 1 year of publications. Physicans were asked in the first section of the questionnaire about their consent to participate. The study was approved from the ethical committee at Ibn Sina National College for Medical Studies at Jeddah. The content validity of the questionnaire was determined by a group of experts consisting of an endocrinologist and an anaesthetologists. The internal consistency of the questionnaire was examined by Cronbach's alpha (0.7).

We considered poor KAP if the right answer was less than 60%. Correctly answered questions were assigned a score of 1. Incorrectly answered questions and those not answered were assigned a score of 0. The total score was calculated for each participant by adding up the scores for each question out of 17 (total right answers). We considered accepte score of KAP if total score was ≥ 8 and low score if < 8 .

Statistical analysis

The results were analyzed with Statistical Program for Social Sciences (SPSS) version 22.0 for windows. Figure 2 was constructured using Excel 2013. Continuous variables were shown as median (not normally distributed), and categorical values were presented percentages. The Chi-square test was performed for comparison between categorical variables and to calculate the odds ratio with its 95% confidence interval. The Pearson correlation test (or spearman) was utilized to assess correlations. A P-value < 0.05 was considered statistically significant.

RESULTS:

Table 1: Demographic and job characteristics and satisfaction among physicians with Comparison between Internists and Anaesthetists.

		All Physicians (n=100) N(%)	Internists. N=47 N(%)	anaesthetologists N=53 N(%)	P
Gender	Females	57(57.0)	33(70.2)	24(45.3)	0.012
	Males	43(43.0)	14(29.8)	29(54.7)	
Age	Media (min-max)	30(23-60)	29(23-60)	30(23-56)	0.584
Working hospitals	Governmental	73(73.0)	36(76.6)	37(69.8)	0.446
	Private	27(27.0)	11(23.4)	16(30.2)	
Professional groups	Consultants	16(16.0)	7(14.9)	9(17)	0.018
	Spechalists	14(14.0)	5(10.6)	9(17)	
	Residents	68(62.0)	35(74.5)	35(66)	
Period of experience: years	Median (min-max)	5(1-35)	4(1-30)	5(1-35)	0.809

Table 2: Comparison between physicians concerning their intraoperative management of diabetes.

Questions	Answers	Total response N=100 N(%)	Internists N=47 N(%)	anaesthetologists N=53 N(%)	P
When do you scheduled the diabetic patients?	Any where **	27(27.0)	8(17)	20(37.7)	0.021 ^{&}
	At the end of the list**	1(1.0)			
	Early in the list*	72(72.0)	39(83)	33(62.3)	
For how long you need patient to fast?	3 hours**	3(3.0)	36(76.6)	48(90.6)	0.057
	6 hours**	21(21.0)			
	8 hours**	60(60.0)			
	Overnight*	16(16.0)	11(23.4)	5(9.4)	
What to do if fasting period is long?	Glucose infusion 5% **	6(6.0)	13(27.7)	7(13.2)	0.071
	VRII**	14(14.0)			
	VRII + 5% glucose*	80(80.0)	34(72.3%)	46(86.8)	
What is the accepted upper limit of HbA1c?	Less than 12**	16(16.0)	19(40.4)	14(26.4)	0.137
	Less than 5**	16(16.0)			
	Less than 9*	68(68.0)	28(59.6)	39(73.6)	
When you should postpone surgery?	HbA1c > 9% *	5(5.0)	25(53.2)	37(69.8)	0.087
	Dehydration*	4(4.0)			
	HHS*	3(3.0)			
	DKA*	39(39.0)			
	Preoperative hyperglycemia*	8(8.0)			
	Preoperative hypoglycemia*	3(3.0)			
	All right *	38(38.0)	22(46.8)	16(30.2)	
Which one of the following will guide your management?	Functional reserve of patients*	6(6.0)	12(25.5)	30(56.6)	0.002 ^{&}
	Pre-operative glycemic control*	20(20.0)			
	Operation type & duration*	16(16.0)			
	All right*	58(58.0)	35(74.5)	23(43.4)	

VRII: variable rate intravenous insulin infusion, HbA1c: glycated hemoglobin, HHS: hyperglycemic hyperosmolar state, DKA: diabetic ketoacidosis, [&]significant, *right answer, **wrong answer.

Table 3: Comparison between physicians concerning capillary blood glucose monitoring during intraoperative management of diabetes.

		Total response N=100 N(%)	Internists N=47 N(%)	anaesthetologists N=53 N(%)	P
What are the best timing for CBG monitor?	Every hour during surgery*	8(8.0)	23(48.9)	33(62.3)	0.180
	More frequent in severe cases*	19(19.0)			
	On admission*	19(19.0)			
	Prior to induction of anesthesia*	10(10.0)			
	All right*	44(44%)	24(51.5)	20(37.7)	
What is intra-operative range of CBG in mg/dl?	>180**	5(5.0)	13(27.7)	13(24.5)	0.722
	<100**	21(21.0)			
	140-180*	74(74.0)	34(72.3)	40(75.5)	
What is the second step in intra-operative CBG > 200 mg/dl with ketonuria?	Check ABG*	79(79)	37(78.7)	42(79.2)	0.949
	Treat as DKA**	22(22)	10(21.3)	11(20.8)	

CBG: capillary blood glucose, ABG: arterial blood gases, DKA: diabetic ketoacidosis, *right answer, **wrong answer.

Table 4: Comparison between physicians concerning variable insulin infusion during intraoperative management of diabetes.

Questions	Answers	Total response N=100 N(%)	Internists N=47 N(%)	anaesthetologists N=53 N(%)	P
When you should start a VRIII?	Right indications (type 1, uncontrolled, emergency)	78(78)	36(76.6)	42(79.2)	0.750
	Wrong indications (all type of type 2)	22(22)	11(23.4)	11(20.8)	
How to use a VRIII?	Right answer (qualified staff, 100 ml/hour glucose infusion with 1 u/h short acting Insulin infusion)	52(52)	27(57.4)	25(47.2)	0.305
	Wrong answer (Sliding scale, SC long acting insulin)	48(48)	20(42.6)	28(52.8)	
What is the best fluid for patients not on VRIII?	Right answer (according to needs)	89(89)	40(85.1)	49(92.5)	0.241
	Wrong answer (dextrose only)	11(11.0)	7(14.9)	4(7.5)	

VRII: variable rate intravenous insulin infusion, u/h: units/hour, SC: subcutaneous

Table 5: Comparison between internists and anaesthetists concerning responsibility, satisfaction, knowledge, attitude and practice of intraoperative diabetes management.

		Total response N=100	Internists N=47	Anaesthetists N=53	P
Intraoperative diabetes management responsibility.	Internists/ Endocrinologists n(%)	62(62)	37(78.7)	25(47.2)	0.001
	Anaesthetists%	38(38)	10(21.3)	28(52.8)	
Satisfaction with the current management: n(%)		88(88.0)	40(85.1)	48(90.6)	0.402
KAP of different professional groups: median (min-max)	Residents	8(3-12)	8(3-12)	7(3-10)	0.447
	Specialists	7.5(4-10)	7(4-10)	8(5-10)	
	Consultants	8(5-10)	9(6-10)	7(5-10)	
KAP score: median (min-max)		8(3-12)	8(4-12)	7(3-11)	0.024

KAP: knowledge, attitude and practice

Figure 1: Correlation between period of experience and the total response score by physicians.

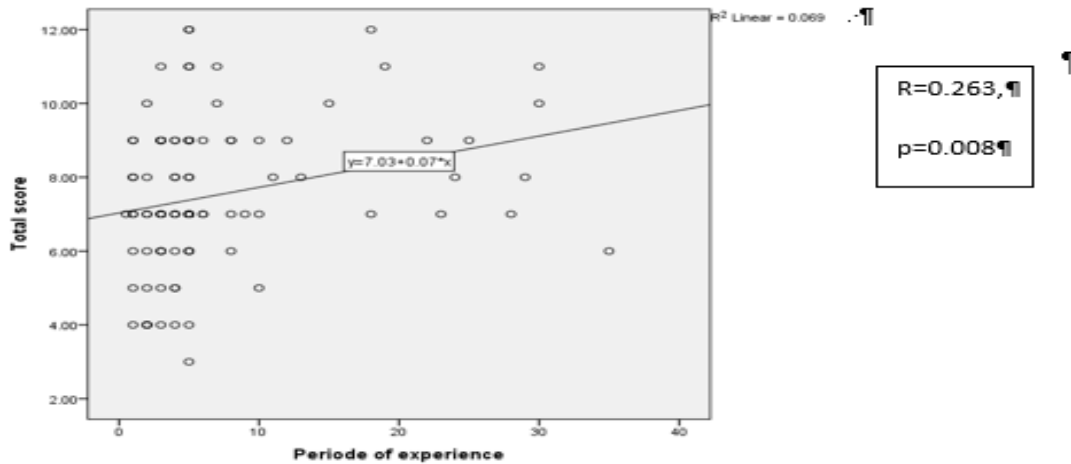
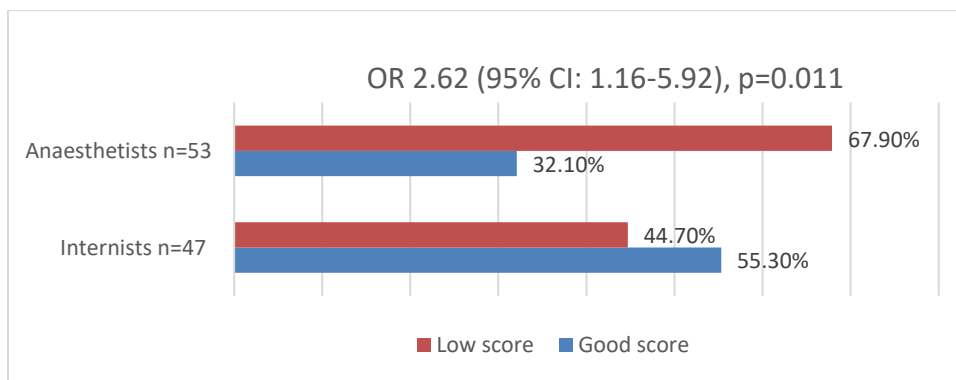


Figure 2: Comparison between internists and anaesthetologists concerning total response score.



OR: Odds Ratio, CI: Confidence Interval.

In total, 100 physicians (43 males and 57 females) agreed to participate in this study. The demographic and job characteristics of the participants are presented in Table 1. Their median age was 30.0 (23.0 -60.0) years, with a median period of experience of 5.00 (1.0-35.0) years. Many were from governmental hospitals (73%), remaining were from private sector (27%), 53% physicians were anaesthetologists and 47% were internists. Residents constituted 62%, followed by consultants (16%) and specialists (14%). Both internists and anaesthetologists were age matched but more male physicians (29.8% vs 54.7%, $p=0.012$) and less residents (66% vs. 74.5%, $p=0.018$) were among the anaesthetologists compared to internists (Table 1).

In table 2, while physicians knew to schedule the diabetic patients early in the list, but anaesthetologists scored significantly lower than internists (83% vs. 62%, $p=0.021$). Sixty % of physicians needed patient to fast for 8 hours while the right answer (overnight fast) was only given by 16% without significant difference between anaesthetists and internists ($p=0.057$). Similarly, physicians did not recognize when to postpone surgery as the right answer was given by 38% only without significant difference between anaesthetologists and internists ($p=0.087$). Factors that guide management were not recognized by physicians (right answers by 58%) especially among anaesthetologists compared to internists (43.4% vs. 74.5%, $p=0.002$).

Table 3 shows that both physicians were matched concerning capillary blood glucose monitoring (CBG) during intraoperative management of diabetes. Most (74%) knew the accepted intraoperative range of CBG, check arterial blood gases in the presence of ketonuria, but not its proper times of monitoring (44%). All participants (100%) recognized the cut off value of low CBG (<70 mg/dl) and know how best they should manage hypoglycemia (data not presented).

In table 4, 78% physicians had the experience of initiating VRIII for indicated patients however, 48% did not know exactly how best they can deliver VRIII during intraoperative management of diabetes. They also knew the fluids that suits diabetic patients if they were not on VRIII (89%).

Table 5 shows the comparison between internists and anaesthetists concerning responsibility, satisfaction, and total score of KAP of intraoperative diabetes management. Many (62%) considered intraoperative

diabetes management as the responsibility of internists/endocrinologists rather than anaesthetologists with 85% of internists considered it as their own task compared to 52.8% of anaesthetists ($p=0.024$). Different professional groups did not differ significantly in their KAP scores ($p=0.447$). The median total KAP score was 8; ranging from 3 to 12 which we considered as accepted KAP. There was significantly lower KAP among anaesthetologists compared to internists (7 (3-12) vs. 8 (3-11), $p=0.024$).

There was a significant correlation between total score and duration of experience ($r=0.263$, $p=0.008$) (Figure 1). Anaesthetologists had increased odds of low KAP scores compared to internists (OR 2.62 (95% CI: 1.16-5.92), $p=0.011$) (Figure 2).

DISCUSSION:

The current study found acceptable KAP and satisfaction of their current intraoperative management of DM among physicians. Their KAP was significantly associated with years of experience but did not differ significantly between professional groups. Physician's highest good KAP were the recognition and management of hypoglycemia (100%), supporting patients while fasting for long period (80%), and intra-operative fluid management (89%).

According to guidelines, the main defects in their KAP were the technique of VRIII (52%), timing of CBG monitoring (44%), fasting period (16%), situations necessitating to postpone surgery, (38%) and factors guiding intraoperative management (58%). Unfortunately, anaesthetologists had 2.62 folds increased odds of low KAP scores compared to internists.

Currently, there is internationally accepted guidelines specifically for the perioperative management of diabetic patients undergoing elective surgery (8,9). However, a universal 'one-size-fits-all' strategy may not be applicable to real-world practice. This could explain the discrepancy between physician's satisfaction with their management despite the presence of many defects when their answers were compared to guidelines.

In respect to the preoperative fasting, most physicians selected 8 hours fasting (60%) rather than overnight fasting (16%). In fact, 8 hour fasting is accepted before elective surgery by most hospital protocols. Similarly, the practice of using VRIII are of utmost importance only in diabetic patients under insulin therapy mainly type 1 or advanced cases of type 2

DM. VRIII recommendations may not be applicable in the context of simple surgeries in an other wise well controlled type 2 diabetes patient.

Some of our respondents (44%) agreed that it is necessary to check CGB on admission, every hour during surgery, more frequent in severe cases, and prior to induction of anesthesia. Most guidelines (8-11) recommend close monitoring of CBG on at least a one- to two-hour basis intraoperatively. This KAP defect is strongly limiting as under anaesthesia hypoglycaemia is usually overlooked. Similar to our findings, other researchers found that most physicians were concerned with perioperative hyperglycaemia than intraoperative hypoglycaemia (12). While perioperative hyperglycemia is associated with increased risk of infection and poor wound healing, hypoglycemia is more serious as it might endanger life. Most of our physicians (74%) accepted the recommended in hospital glycaemic target of 140–180 mg/dL for surgical wards (13). All of the physicians surveyed addressed and well managed hypoglycaemia of <70 mg/dl and would prompt them to cancel the surgery.

Interestingly, their defective responses concerning when to postpone surgery (38%) and what guide intraoperative management (58%) may be interpreted as a major limitation of their management. On the other hand, these 2 questions depend on their personal experience and the types of cases they have faced. This is supported by our finding of a significant positive correlation between the physicians' KAP and years of experience. Clinicians might favour the treat-and-defer approach over postponing surgery for economic and resources reasons (14).

Unfortunately, anaesthetologists in our study had 2.62 folds increased odds of low KAP scores compared to internists, despite including significantly more professional physicians ($p=0.018$). In addition, more than half of the anaesthetologists considered themselves responsible for Intraoperative diabetes management. Perioperative guidelines for diabetes management are extensive and exhaustive for anaesthetologists to follow. New guidelines should specify a section for intraoperative management and to be directed to the anaesthetologists.

The main strength of our study is exploring the anaesthetic management intraoperatively rather than the whole process of perioperative management of diabetic patients. Moreover, comparing them to internists could delineate the points for improvement

of the anaesthetic practice. The main limitation is the self-answered questionnaire and the cross sectional study design that allow recall bias.

In conclusion, the current study presented the prevalent KAP of both internists and anaesthetologists towards intraoperative management of diabetic patients undergoing elective surgery in both governmental and private hospitals in Saudi Arabia. Most KAP defects reported in the current study reflect on the differences in local management protocols and guidelines, professional profile, duration of experience and surgical workload. Of note, more than 60% of the respondents were residents. However, this did not bias our findings as residents in the resident program are under direct supervision by a specialist or consultant. There is a need to improve physicians' KAP throughout both governmental and private hospitals probably through implementation of recent guidelines. Further research in the same field is recommended for the future formulation of new protocols concentrating on intraoperative management and to be directed to anaesthetologists.

REFERENCES:

1. Frisch A, Chandra P, Smiley D, et al. Prevalence and clinical outcome of hyperglycemia in the perioperative period in noncardiac surgery. *Diabetes Care* 2010; 33: 1783–8. [PubMed]
2. Stamler J, Vaccaro O, Neaton JD, Wentworth D. Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the Multiple Risk Factor Intervention Trial. *Diabetes Care* 1993; 16: 434–44. [PubMed]
3. National Patient Safety Agency . Insulin safety. Reducing harm associated with the unsafe use of insulin products. <http://www.nrls.npsa.nhs.uk/resources/collection/s/10-for-2010/insulin/?entryid45=74287> (accessed 11/08/2015).
4. Jhanji S, Thomas B, Ely A, Watson D, Hinds CJ, Pearce RM. Mortality and utilisation of critical care resources amongst high-risk surgical patients in a large NHS trust. *Anaesthesia* 2008; 63: 695–700. [PubMed]
5. Pearce RM, Harrison DA, James P, et al. Identification and characterisation of the high-risk surgical population in the United Kingdom. *Critical Care* 2006; 10: R10. [PubMed]
6. Sampson MJ, Brennan C, Dhatariya K, Jones C, Walden E. A national survey of in-patient diabetes services in the United Kingdom. *Diabetic Medicine* 2007; 24: 643–9. [PubMed]
7. George JT, Warriner D, McGrane DJ, et al. Lack

- of confidence among trainee doctors in the management of diabetes: the Trainees Own Perception of Delivery of Care (TOPDOC) Diabetes Study. *Quarterly Journal of Medicine* 2011; 104: 761–6.
8. Membership of the Working Party, P. Barker, P. E. Creasey, K. Dhatariya, I N. Levy, A. Lipp, 2 M. H. Nathanson, Chair, N. Penfold, 3 B. Watson, and T. Woodcock. Peri-operative management of the surgical patient with diabetes 2015. Association of Anaesthetists of Great Britain and Ireland. *Anaesthesia*. 2015 Dec; 70(12): 1427–1440.
 9. Cosson E, Catargi B, Cheisson G, Jacqueminet S, Ichai C, Leguerrier AM, Ouattara A, Tauveron I, Bismuth E, D. Benhamou d , P. Valensi a. Practical management of diabetes patients before, during and after surgery: A joint French diabetology and anaesthesiology position statement. *Diabetes & Metabolism* 44 (2018) 200–216.
 10. Dhatariya K, Flanagan D, Hilton L, et al. Management of adults with diabetes undergoing surgery and elective procedures: improving standards April 2011 [online] [Accessed December 1, 2012]. Available at: <https://www.diabetes.org.uk/Documents/Professionals/Reports%20and%20statistics/Management%20of%20adults%20with%20diabetes%20undergoing%20surgery%20and%20elective%20procedures%20-%20improving%20standards.pdf>.
 11. Lobo DN, Dhatariya K, Levy N, et al. The peri-operative management of the adult patient with diabetes May 2012. In: Association of Surgeons of Great Britain and Ireland. *Issues in Professional Practice* [online] [Accessed December 1, 2012]. Available at: <http://www.asgbi.org.uk/download.cfm?docid=7E50EF96-644D-43D0-BE55D179D89C7C07>.
 12. Woo JH, Di Ng W, Salah MM, Neelam K, Eong KA, and Kumar CM. Perioperative glycaemic control in diabetic patients undergoing cataract surgery under local anaesthesia: a survey of practices of Singapore ophthalmologists and anaesthesiologists. *Singapore Med J*. 2016 Feb; 57(2): 64–68.
 13. Moghissi ES, Korytkowski MT, DiNardo M, American Association of Clinical Endocrinologists; American Diabetes Association American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. *Endocr Pract*. 2009;15:353–69.
 14. Perroca MG, Jericó Mde C, Facundin SD. Surgery cancelling at a teaching hospital: implications for cost management. *Rev Lat Am Enfermagem*. 2007;15:1018–24. [PubMed]