

Referrral Systems Development and Survey of Perioperative and Critical Care Referral to Anesthetists

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Abstract

Introduction: Anesthetists come in contact with more than two-third of hospital patients. Timely referral to anesthetists is vital in perioperative and remote site settings. Delayed referrals, improper referrals, and referrals at inappropriate levels can result in inadequate preparation, perioperative complications, and poor outcome. **Methods:** The self administered paper survey to delegates attending anesthesia conferences. Questions were asked on how high-risk, emergency surgical cases remote site and critical care patients were referred to anesthetists and presence of rapid response teams. **Results:** The response rate was 43.8%. Sixty percent (55.3–64.8, $P = 0.001$) reported high-risk elective cases were referred after admission. Sixty-eight percent (63.42–72.45, $P = 0.001$) opined preoperative resting echocardiographs were useful. Six percent (4.16–8.98, $P = 0.001$) reported emergency room referral before arrival of the patient. Twenty-five percent (20.92–29.42, $P = 0.001$) indicated high-risk obstetric cases were referred immediately after admission. Consultants practiced preoperative stabilization more commonly than residents (32% vs. 22%) ($P = 0.004$). For emergency surgery, resident referrals occurred after surgery time was fixed (40% vs. 28%) ($P = 0.012$). Residents dealt with more cases without full investigations in obstetrics (28% vs. 15) ($P = 0.002$). Remote site patients were commonly referred to residents after sedation attempts (32% vs. 20%) ($P = 0.036$). Only 34.8 said hospitals where they practiced had dedicated cardiac arrest team in place. **Conclusions:** Anesthetic departments must periodically assess whether subgroups of patients are being referred in line with current guidelines. Cancellations, critical incidents and complications arising out of referral delays, and improper referrals must be recorded as referral incidents and a separate referral incident registry must be maintained in each department. Regular referral audits must be encouraged.

Keywords: Perioperative, referral incidents, referral registry

INTRODUCTION

Anesthetists come in contact with more than two-third of hospital patients.^[1] Referral to anesthetists occurs not only to provide services in operating theaters but also other areas such as emergency rooms, remote sites, wards, and intensive care. Only about 50% of anesthetists time is spent in the operation theater; rest is divided to preparation of patients, obstetric units, critical care, pain relief, emergency department, and radiology. Timing of these referrals is crucial for optimal care of the patients. However, there are no studies or surveys to reflect overall referral scenarios in anesthetic practice. We aim to study how perioperative and critical care referrals across different practice areas occur in anesthesia and intensive care settings and whether these were in line with current standards and guidelines.

We conducted a survey of delegates attending anesthesia conferences. The study was undertaken to assess how high-risk elective cases, emergency surgery, remote site, critical care, and emergency room patients were referred patients in relation to the time of admission, surgery, or procedure and to assess whether referral to anesthetists was in time for optimal care and to suggest measures for developing and improving the referral systems.

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METHODS

The University Institutional Ethical Committee approval was obtained for the survey. After piloting, a 15-point questionnaire was designed, covering the areas of general surgical, obstetric critical care, remote site, and pediatric anesthetic practice. Questions were related to how cases were referred to anesthetists and sought their opinion on preoperative medical consultations, preoperative echocardiograph, and preoperative stabilization, anesthetists' role in neonatal resuscitation, role in Intensive Care Units (ICUs) managed primarily by physicians, and the presence of a cardiac arrest or rapid response team in their hospital. These paper questionnaires [Appendix 1] were administered to anesthesia delegates attending two (one multistate Zonal level and one state level) anesthesia conferences at two different metropolitan cities scheduled about 3 weeks apart. Repeat participants in the second conference were excluded from the study. Statistical analysis was done using STATA version 12.0 (StataCorp LP, Texas, USA).

Individual question analysis was performed with Chi-square goodness of fit with *csqof* download in Stata. Question and grade comparisons were performed with Chi-square test and Fishers exact test where appropriate. Results were reported as percentages and confidence interval for proportions with $P < 0.05$ as statistically significant.

RESULTS

A total of 460 questionnaires were returned out of distributed 1050, giving a response rate of 43.8%. Multiple responses for the same question were considered invalid and unfilled as nonresponses.

Distribution of faculty and students

Consultants and residents constituted almost equal proportions, and only 48 (10%) constituted independent practitioners [Figure 1].

Elective high-risk cases, medical consultations, and role of preoperative echocardiograph

Only 17% of the respondents opined that high-risk elective cases were referred before admission, 61% agreed referrals occurred after admission, and 22% stated referral occurred after date of surgery was fixed ($P < 0.001$) [Figure 2].

When medical consultation occurred, more respondents were willing for team decision on fitness for surgery than anesthetist decision and 23% felt that physicians decided on fitness for surgery (187, 147, 103, 42%, 33%, and 23%, $P < 0.001$). A significant proportion of respondents was of the opinion that a preoperative resting echocardiogram for high-risk noncardiac surgery will help tailor anesthetic technique for induction and anticipate complications intra- and post-operatively (292, 97, 68% and 23%, $P < 0.001$). Table 1 illustrates the respondent's opinion on different characteristics [Table 1].

Emergency surgery referrals, preoperative optimization, and emergency room referrals

Fifty-seven percent respondents agreed that emergency laparotomy and polytrauma referrals occurred soon after admission while 35% opined that referral occurred after surgical time fixed in their hospitals. Eight percent respondents agreed that cases were commonly brought to theater without prior information ($P < 0.001$). Only 26% optimized more than ten emergency surgical cases preoperatively in the last year, 17% 5–9 cases, 38% 1–4 cases, and 19% did not optimize a single patient ($P < 0.001$). In the emergency room, only 6% agreed that referral occurred before the arrival of the patient compared to referrals after recognition and after intubation attempts (27, 309 and 95, 6%, 72% and 22%, $P < 0.001$).

Obstetric and neonatal referrals

A greater proportion of respondents felt that high-risk obstetric cases were referred after investigations than brought to theater directly and only 25% opined that referrals occurred immediately after admission (224, 91, 105, 53%, 22% and 25% $P < 0.001$). The proportion of anesthetists participating in neonatal resuscitation voluntarily or when the pediatrician asked was almost equal (190 and 184, 45% vs. 44%). Ten percent of respondents said pediatrician was not available routinely (44, $P < 0.001$). Intubation rather than airway maneuvers was the most common help required by the pediatrician during neonatal resuscitation (278, 93, 68% and 22%, $P < 0.001$) [Figure 3].

Remote site and critical care, rapid response team referrals

In computed tomography (CT)/magnetic resonance imaging (MRI) areas, 57% of respondents agreed that pediatric referral occurred soon after admission, 25% agreed that referral occurred after sedation attempts, and 14% about the time of shifting ($P < 0.001$). Fifty-four percent of respondents were working in intensive care led by anesthetists and intensivists, 21% in physician-led, and 10% of respondents were not involved in critical care activity. For medical patients requiring ventilation, significant number of respondents agreed that referral occurred only after rather than before respiratory compromise and periarrest referrals in 3.5% (158, 117, 37%

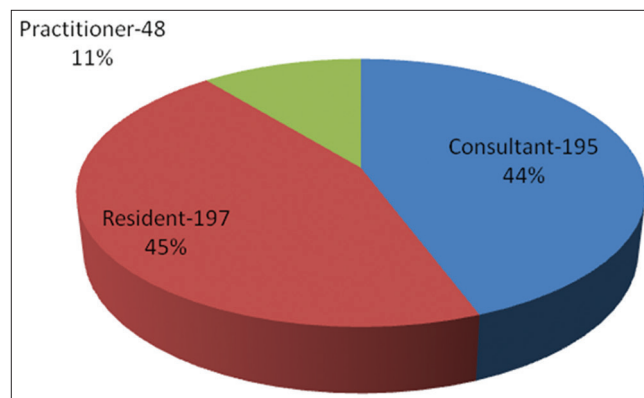


Figure 1: Distribution of grades of respondents

Table 1: Respondents overall opinion on perioperative and critical care referrals

Characteristic	n (%)	95% CI	P
Fitness decision during medical consultation			
Anesthetist decision	147 (33.64)	29.21-38.28	<0.001
Team decision	187 (42.79)	38.10-47.58	
Physician decision	103 (23.57)	19.66-27.83	
Invalid/nonresponse	3		
Preoperative resting echocardiograph			
Will not lead to improved outcome	40 (9.32)	6.74-12.48	<0.001
Continue till more evidence available	97 (22.61)	18.73-26.86	
Will help tailor anesthetic technique	292 (68.06)	63.42-72.45	
Invalid/nonresponse	11		
Polytrauma and emergency surgery referrals			
Soon after admission	249 (57.63)	52.82-62.34	<0.001
After surgery, time fixed	150 (34.72)	30.23-39.42	
To operation theater directly	33 (07.63)	05.31-10.56	
Preoperative optimization/ICU utilization			
>10 cases	112 (26.04)	21.95-30.46	<0.001
5-9 cases	73 (16.97)	13.54-20.86	
1-4 cases	165 (38.37)	33.75-43.15	
None	80 (18.60)	15.03-22.61	
Nonresponses	10		
Emergency room referrals			
Informed before arrival	27 (6.2645)	4.16-8.98	<0.001
Informed as soon as recognized to need anesthetic intervention	309 (71.86)	67.35-76.06	
Referred after initial intubation/cannulation attempt	95 (22.093)	18.25-26.31	
Invalid/nonresponse	9		
High-risk cesarean section referrals			
Soon after admission	105 (25)	20.92-29.42	<0.001
After investigations	224 (53.33)	48.43-58.18	
Without investigations	91 (21.66)	17.81-25.91	
Invalid/nonresponse	20		
Time of anesthesiologists intervention in neonatal resuscitation			
When pediatrician asks	190 (45.45)	40.60-50.36	<0.001
Volunteer when pediatrician seems struggling	184 (44.01)	39.19-48.92	
No pediatrician routinely	44 (10.52)	07.75-13.87	
Pediatric referrals from CT/MRI			
Soon after decision to	218 (57.21)	52.07-62.24	<0.001
Just before or after shifting	65 (17.06)	13.42-21.22	
Informed after sedation attempts by pediatrician	98 (25.72)	21.40-30.42	
Invalid/nonresponses	4/55		

Contd...

Table 1: Contd...

Characteristic	n (%)	95% CI	P
Type of ICU			
Anesthetists/intensivists led	229 (54.13)	49.25-58.96	<0.001
Team of physician and anesthetists	61 (14.42)	11.21-18.13	
Physician led	91 (21.51)	17.68-25.73	
Not involved	42 (9.92)	7.25-13.18	
Invalid/nonresponse	17		
Ventilation referrals			
Anesthetists routinely	88 (20.80378)	17.03-24.98	<0.001
Before respiratory compromise	117 (27.65957)	23.44-32.18	
After respiratory compromise	158 (37.35225)	32.72-42.15	
Periarrest	15 (03.5461)	01.99-05.78	
Not involved	45 (10.6383)	07.86-13.97	
Presence of rapid response team			
Yes	154 (35.81)	31.27-40.54	<0.001
No	276 (64.18)	59.45-68.72	
Nonresponse	10		

P value calculated by Chi-square goodness of fit. Invalid and nonresponses for each question are excluded from denominator when calculating percentages and CIs. CT=Computed tomography, MRI=Magnetic resonance imaging, ICU=Intensive Care Unit, CIs=Confidence intervals

and 27%, $P < 0.001$). About 20% opined that anesthetists were involved in routinely in care of such medical patients before ventilation referrals. A significant proportion of the respondents agreed about the absence of cardiac arrest team in their hospitals (276 and 154, 64% vs. 34%, $P < 0.001$).

Comparison of referral opinions across grades

Table 2 lists the comparison of different referral characteristics between consultant, residents, and practitioners. Elective high-risk cases were more commonly referred before admission to consultants than residents (26% vs. 8%, odds ratio [OR] 4.007) and after surgery date fixed commonly referred to residents (30% vs. 14%, OR 0.375, $P = 0.001$). More consultants (49% vs. 36%, OR 1.7644) agreed for team decision to decide fitness and more residents (30% vs. 16%, OR 0.4369) agreed that physicians decided fitness ($P = 0.011$). For echocardiograph and emergency room referrals and airway intervention in neonatal resuscitation, there was no significant difference of opinion across all grades. However, more consultants were likely to say echocardiograph not useful (OR 2.2081) and less likely to be referred cases after intubation attempts in emergency room (OR 0.6346). For emergency surgery, significant number of consultants agreed that referral occurred soon after admission (64% vs. 50%, OR 1.8362) while residents agreed that referrals occurred after surgery time was fixed (40% vs. 28%) ($P = 0.012$). Interestingly, none of the independent practitioners agreed for cases being brought to theater directly.

Polytrauma and emergency surgery cases were referred more commonly to consultants soon after arrival (64% vs. 50% $P = 0.012$, OR 1.7644). Consultants used intensive

care for preoperatively stabilization more commonly than residents (32% vs. 22% OR for >10 cases 1.6301, OR for not utilizing ICU 0.5543) ($P = 0.004$). High-risk obstetric cases were commonly referred to consultants soon after admission (30% vs. 17%, OR 2.0899) and residents dealt with more cases without full investigations (28% vs. 15%, OR 0.5351) ($P = 0.002$). Consultants were slightly more likely to assist neonatal resuscitation by intubation (OR 1.2996) Immediate referrals from CT/MRI occurred to consultants (64% vs. 48%, OR 1.9403) while cases were commonly referred to residents after sedation attempts (32% vs. 20%, OR 0.5507, $P = 0.036$). In ICU, settings referral after respiratory arrest commonly occurred to residents (44% vs. 34%, OR 0.6490, $P = 0.002$). None of the independent practitioners was referred a patient in periarrest situation.

DISCUSSION

High-risk elective referrals

Only 17.6% of respondents agreed that elective high-risk cases were referred before admissions. The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) 2002 Report recommends that high-risk elective cases are

informed before admission.^[2] This will avoid unnecessary cancellations and anticipate and prevent perioperative complications. The NCEPOD 2011 report has listed predictors of complications.^[3] High-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular procedures), ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, insulin therapy for diabetes mellitus, and preoperative creatinine level >176 $\mu\text{mol/L}$. The risk of perioperative major cardiac event increases from 0.6% with one predictor to 6.6% with two predictors and reaches 11% with three predictors. Identification of high-risk patients is complex and that possibly no single method covers all.^[3]

Anesthesia departments should identify patient groups which need to be informed before admission. Surgeons perceived an increased risk in only 66% of the patients that actually died in NCEPOD 1992.^[4] Although these guidelines do exist, effective communication to surgical colleagues is equally important. Surgical colleagues must identify probable high-risk admissions at every out-patient day, refer them to preassessment clinic same day, and a senior anesthetic trainee or consultant should visit the preassessment clinic to assess these patients before admission.

Medical consultations and preoperative resting echocardiograph

Forty-two percent respondents favored a team decision compared with 23% for fitness decided by a physician and 31% opined fitness decided solely by anesthetists.

NCEPOD 2002 emphasizes the clear communication between the surgeon, anesthetist, and physician to understand each other's concerns.^[3] It would be more appropriate for the anesthetist to seek additional consultations at an appropriate level if concerns remain, even after the initial physician consultation. This is more so if a junior medical trainee has evaluated the patient for fitness for surgery.

A recent observational study of 264,823 patients over 9 years suggested that a preoperative echocardiogram is not associated with improved outcomes.^[5] However, the limitations of this study were observational, the details of the echocardiogram

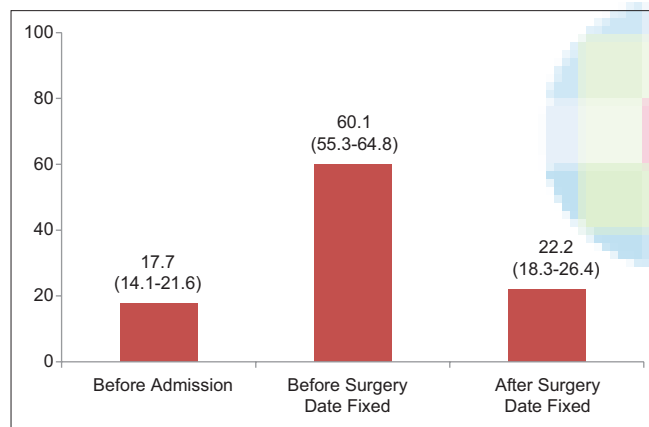


Figure 2: Respondents opinion on referral of high-risk elective cases. Open figures indicate percentages. In brackets, 95% confidence intervals

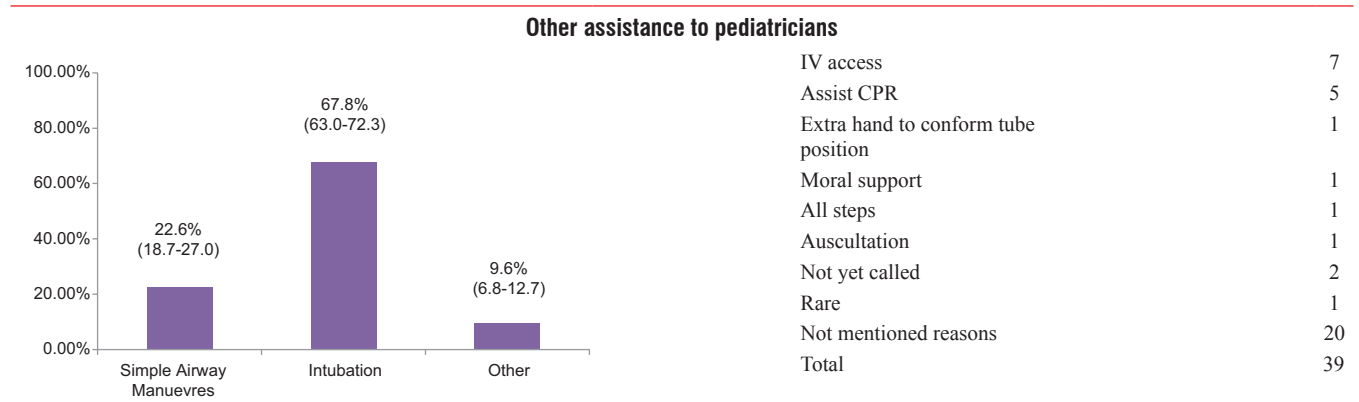


Figure 3: Airway interventions by anesthetists in neonatal resuscitation during cesarean section. All digits in figure-percentages, in brackets 95% confidence intervals. Digits in inset table indicate actual numbers of respondents

Table 2: Comparison of opinions across respondent grades and characteristics

Characteristic	Consultant		Resident		Practitioner		OR (95% CI) for consultant/resident	P
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI		
High-risk referrals								
Before admission	48 (26.37)	19.91-32.83	16 (8.20)	4.31-12.09	11 (23.40)	10.83-35.97	4.0075 (2.1807-7.3644)	<0.001
Before surgery date but after admission	108 (59.34)	52.13-66.54	119 (61.02)	54.11-67.93	28 (59.57)	45.00-74.13	0.9321 (0.6169-1.4083)	
After surgery date fixed	26 (14.28)	9.15-19.41	60 (30.76)	24.23-37.30	8 (17.02)	5.86-28.17	0.375	
Fitness decision when medical consultation occurs								
Anesthetists decides	66 (34.19)	27.44-40.94	66 (33.50)	26.85-40.15	15 (31.91)	18.08-45.74	1.0315 (0.6781-1.5691)	0.011
Team decides	96 (49.74)	42.62-56.85	71 (36.04)	29.27-42.80	20 (42.55)	27.87-57.22	1.7564 (1.1712-2.6339)	
Physician decides	31 (16.06)	10.83-21.28	60 (30.45)	23.97-36.93	12 (25.53)	12.59-38.47	0.4369 (0.2678-0.7129)	
Preoperative resting echocardiograph								
Not useful	25 (13.02)	8.21-17.82	12 (6.34)	2.84-9.85	3 (6.25)	0.85-13.35	2.2081 (1.0747-4.5367)	0.167
Continue till more evidence	40 (20.83)	15.03-26.62	43 (22.75)	16.71-28.78	14 (29.16)	15.82-42.50	0.8935 (0.5491-1.4538)	
Help tailor anesthetic technique	127 (66.14)	59.39-72.89	134 (70.89)	64.36-77.43	31 (64.58)	50.54-78.610	0.802 (0.5199-1.237)	
Polytrauma and emergency surgery referrals								
Soon after admission	123 (64.06)	57.21-70.91	98 (50.25)	43.17-57.33	28 (62.22)	47.49-76.95	1.7644 (1.1744-2.6509)	0.012
After surgery time fixed	54 (28.12)	21.70-34.54	79 (40.51)	33.56-47.46	17 (37.77)	23.04-52.50	0.5746 (0.3756-0.879)	
Brought to the at redirectly	15 (7.81)	3.98-11.64	18 (9.23)	5.13-13.32	0		0.8333 (0.4072-1.7055)	
Preoperative stabilization in ICU								
>10 cases	63 (32.64)	25.96-39.31	44 (22.91)	16.91-28.91	5 (11.11)	1.56-20.65	1.6301 (1.0379-2.5601)	0.004
5-9 cases	30 (15.54)	10.38-20.70	28 (14.58)	9.54-19.62	15 (33.33)	19.01-47.65	1.078 (0.6165-1.8849)	
1-4 cases	72 (37.30)	30.42-44.18	75 (39.06)	32.09-46.02	18 (40)	25.11-54.88	0.9283 (0.6152-1.4005)	
None	28 (14.50)	9.49-19.52	45 (23.43)	17.39-29.48	7 (15.55)	04.54-26.56	0.5543 (0.5543-0.3291)	
Emergency room referrals								
Informed before arrival	14 (7.29)	3.58-11.00	12 (6.15)	2.75-9.55	1 (2.27)	2.31-6.85	1.2781 (0.5758-2.837)	0.203
Informed after recognition	142 (73.95)	67.69-80.22	131 (67.1)	60.53-73.82	36 (81.81)	69.95-93.67	1.3875 (0.894-2.1535)	
After intubation attempts	36 (18.75)	13.17-24.32	52 (26.66)	20.40-32.92	7 (15.90)	4.66-27.15	0.6346 (0.392-1.0274)	
High-risk obstetrics								
Intimated soon after admission	55 (30.38)	23.62-37.15	33 (17.27)	11.86-22.68	17 (35.41)	21.38-49.45	2.0899 (1.2791-3.4148)	0.002
Before shifting, but after investigations	98 (54.14)	46.81-61.47	103 (53.92)	46.79-61.05	23 (47.91)	33.25-62.57	1.0088 (0.6708-1.5169)	
Without complete investigations	28 (15.46)	10.15-20.78	55 (28.79)	22.31-35.27	8 (16.66)	5.73-27.60	0.5351 (0.3142-0.9113)	
Time of intervention in neonatal resuscitation								
Pediatrician asks	80 (44.19)	36.89-51.50	90 (47.61)	40.43-54.80	20 (41.66)	27.19-56.13	0.9153 (0.6092-1.3751)	<0.001
Volunteer	84 (46.40)	39.07-53.74	87 (46.03)	38.86-53.20	13 (27.08)	14.04-40.12	1.0153 (0.6746-1.5281)	
No pediatrician routinely	17 (9.39)	5.10-13.68	12 (6.34)	2.84-9.85	15 (31)	17.64-44.85	1.529 (0.7087-3.2986)	
Airway intervention in neonatal resuscitation								
Simple airway maneuvers	33 (18.33)	12.62-24.04	50 (27.47)	20.92-34.01	10 (20.83)	8.91-32.75	0.5927 (0.36-0.9756)	0.279
Intubation	127 (70.55)	63.83-77.27	118 (64.83)	57.83-71.83	33 (68.75)	55.14-82.35	1.2996 (0.8354-2.0219)	
Other	20 (11.11)	6.47-15.74	14 (7.69)	3.78-11.60	5 (10.41)	1.45-19.38	1.5 (0.7327-3.0708)	
Remote site pediatric referrals								
Soon after decision	112 (64.36)	57.18-71.55	81 (48.21)	40.58-55.84	25 (64.10)	48.34-79.85	1.9403 (1.2579-2.9929)	0.036
Within minutes of shifting	26 (14.94)	9.59-20.29	33 (19.64)	13.57-25.71	6 (15.38)	3.53-27.23	0.7187 (0.4087-1.2637)	
After sedation attempts	36 (20.68)	14.61-26.76	54 (32.14)	25.00-39.27	8 (20.51)	7.25-33.77	0.5507 (0.3376-0.8983)	

Contd...

Table 2: Contd...

Characteristic	Consultant		Resident		Practitioner		OR (95% CI) for consultant/resident	P
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI		
Type of ICU								
Anesthetists/intensivists led	110 (57.89)	50.81-64.97	104 (55.02)	47.86-62.18	15 (34.09)	19.51-48.66	1.1238 (0.7486-1.6871)	<0.001
Team led	27 (14.21)	9.20-19.22	28 (14.81)	9.70-19.92	6 (13.63)	3.08-24.19	0.9525 (0.5377-1.6872)	
Physician led	37 (19.47)	13.79-25.15	45 (23.80)	17.68-29.93	9 (20.45)	8.04-32.85	0.7739 (0.4737-1.2643)	
Not involved	16 (8.42)	4.43-12.40	12 (6.34)	2.84-9.85	14 (31.81)	17.49-46.14	1.3563 (0.6235-2.9505)	
Ventilation referral in ICU								
Anesthetists routinely	41 (21.69)	15.76-27.62	36 (19.14)	13.47-24.82	11 (23.91)	11.10-36.72	1.1697 (0.7083-1.9316)	0.002
Before respiratory compromise	55 (29.01)	23.09-35.94	49 (26.06)	20.31-32.77	13 (28.26)	17.32-42.55	1.1643 (0.7407-1.8302)	
After respiratory compromise	65 (34.39)	27.55-41.22	84 (44.68)	37.50-51.85	9 (19.56)	7.65-31.47	0.6490 (0.4283-0.9835)	
Periarrest	8 (4.23)	1.33-07.12	7 (3.72)	0.99-6.45	0	0	1.1429 (0.4059-3.2176)	
Not involved	20 (10.58)	6.15-15.00	12 (6.38)	2.85-9.90	13 (28.26)	14.74-41.77	1.7357 (0.823-3.6604)	
Presence of rapid response team								
Yes	81 (42.40)	35.33-49.48	58 (30.36)	23.78-36.94	15 (31.25)	17.64-44.85	1.6886 (1.1081-2.5732)	0.039
No	110 (57.59)	50.51-64.66	133 (69.63)	63.05-76.21	33 (68.75)	55.14-82.35		

Percentages and CIs calculated for each grade column wise. *P* values have been calculated for the entire group in each characteristic. Consultant/resident ORs are calculated for each row values against the sum of other two rows in each characteristic. CIs=Confidence intervals, ORs=Odds ratios, ICU=Intensive Care Unit

were not available, and data on postoperative complications were lacking. Patients who had echocardiography were also more likely to have received new prescriptions for β blockers, statins, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers before surgery. Thus, increased mortality in patients with echocardiography was more likely due to these new drugs. 2014 ACC/AHA perioperative guidelines do not recommend routine preoperative evaluation of the left ventricular (LV) function. LV function assessment is recommended in heart failure, dyspnea, or other change in clinical status and also in clinically stable patients with previously documented LV dysfunction if there has been no assessment within the last year.^[6]

Sixty-eight of the respondents were of the view that a preoperative echocardiogram is useful to tailor the anesthetic technique despite lack of available evidence. Only 9% opined echocardiograph will not improve outcome. As perioperative physicians, there may be a role of preoperative echocardiograph done by anesthetists, and this may not be followed by overprescribing.

Emergency surgery and preoperative optimization

Thirty-four percent of respondents opined that emergency surgery referrals occurred after surgical time was decided and 8% agreed that cases were brought directly to theater.

The current mortality for emergency laparotomy is 14.9%.^[7] The NCPOD 2011 report has clearly demonstrated the need to fully resuscitate patients before emergency surgery. The mortality rate is 30% for patients with hypovolemia compared to 5.4% without hypovolemia. Among the hypovolemic group, mortality rises to 55% if this is untreated and reduces to 21%

with adequate preoperative fluid therapy. While early surgery is of paramount importance in emergencies, early referral and involvement of the anesthetist in preoperative resuscitation are desirable.

The Royal College of Anaesthetists' (RCOA) guidelines clearly emphasizes the involvement of critical care, preferably before emergency surgery.^[8] Only 26% optimized more than ten cases in the last year. Critical care involvement was poor with more than 38% optimizing between one and four cases while 18% had not optimized even a single case in the last year. Meta-analysis and reviews have shown that optimization is beneficial.^[9] Identifying which patient will benefit has been suggested based on various scoring systems and type of surgeries such as colorectal/intraabdominal, emergency surgery, trauma involving more than two body cavities, and prolonged surgery. Cited reasons for not practicing optimization include a lack of experience with the practicalities of perioperative optimization and lack of knowledge in applying currently available tools.^[9] Although resuscitation can be undertaken in the anesthetic room, critical care or high-dependency beds or even recovery areas must be engaged where appropriate.

Emergency room referrals

Twenty-two percent agreed that referral occurred after initial attempts at intubation or cannulation. In a Scottish study, anesthetists achieved better views with the laryngoscope in emergency room (success rate 91.8% compared to 83.8% for emergency physicians).^[10] Emergency physicians perform rapid sequence intubation in more critical patients (32% vs. 11%) within 15 min of arrival. However, esophageal intubations with emergency physicians were 4.5% compared to 1.69%

with anesthetists. In the National Audit Project of RCOA, the death/brain damage rate in emergency department was 33%, higher than anesthesia (14%) but less than ICU (61%).^[11] Correct use and interpretation of capnography would have prevented half of the deaths in the emergency department. The most frequent positive factor being communication. NAP4 recommends that all practitioners who may be called upon to manage airway emergencies in the emergency department must have the required skills and experience, with immediate access to senior supervision. This is particularly important for trainees in emergency medicine and critical care. Good and ongoing communication between senior clinicians in the emergency department, anesthesia, critical care, ear, nose, and throat and other relevant specialties are essential in planning for, and managing, the emergency airway problems that present to the emergency.^[11,12]

Only 6% of respondents felt that they were informed before the arrival of the patient in the emergency room. This reflects delayed communication to the anesthetist from the emergency area or poor notification from paramedics in this part of the world.

Obstetric and pediatric services

Twenty-five percent agreed that cases were not referred immediately after admission and 22% opined referral occurred without proper investigations. The joint Association of Anesthetists of Great Britain and Ireland (AAGBI)/Obstetric Anesthetists' Association guidelines^[13,14] emphasize that anesthetist needs to be given sufficient advance notice of all potentially high-risk patients.^[13,14] 2007 CEMACH report recommends women with significant hemorrhage, pregnancy-induced hypertension (PIH), sepsis, and high body mass index should also receive joint care from an early stage and use of obstetric early warning scoring system to help in the more timely recognition, treatment, and referral of women who have or are developing a critical illness.^[15] The RCOA suggested indicator for obstetric services is percentage of PIH who were known to the anesthetist within 1 h after arrival on the labor ward.^[16] A unit policy should exist for criteria for informing the anesthetist as recommended by RCOA.

Intubation (67% respondents) as compared to airway maneuver or other assistance was the most common help requested by the pediatricians during neonatal resuscitation. AAGBI obstetric guideline has stated that anesthetists should work with the neonatal team to ensure that appropriate training is delivered and maintained.^[13] In a survey of staff involved in neonatal resuscitation in Australia, 85% of tertiary respondents had a training program available to them compared with 59% of urban nontertiary staff and 31% of rural practitioners.^[17] Three-quarters of all births took place in rural or urban nontertiary hospitals where one-third of health personnel are inadequately trained in neonatal resuscitation and many did not feel confident in their skills. Although national/international guidelines exist, regular audit must be encouraged at local level. Regular training and skill update of staff involved

in neonatal resuscitation in line with current guidelines and requirements at local level are necessary.

Remote site and critical care referrals

Twenty-five percent of respondents agreed that referrals from CT/MRI occurred after sedation attempts by nonanesthetists, while 17% agreed that information was provided a few minutes before or after moving the child. These represent either inadequate or failure of sedation just before or after arrival in scan room. Failure rates can be improved by proper selection of technique in the first instance and involvement of a dedicated team.^[18] A multidisciplinary team of anesthetists, radiologists, and pediatricians have been suggested.^[19] The 2010 UK National Institute for Health and Care Excellence guideline recommends each healthcare professional and their team delivering sedation should ensure they update their theoretical knowledge and practical skills through programs designed for continuing professional development.^[20]

More than 54% of respondents worked in intensive care led by anesthetists/intensivists, and 22% were led by physicians. For ventilatory referrals for medical illness such as pneumonia, 37% respondents agreed referrals occurred after respiratory compromise in the anesthetist/intensivist-led ICU. In a comparative study of medical ICU patients cared for by a hospitalist or an intensivist-led team, although the adjusted mortality and length of stay demonstrated no statistically significant difference, mechanically ventilated patients with intermediate illness severity showed improved length of stay, and a trend toward improved mortality when cared for by an intensivist-led ICU teaching team.^[21] In a meta-analysis of 52 studies, high-intensity staffing was associated with reduced ICU and hospital length of stay and mortality rates.^[22] In this survey, some ICUs though led by physicians, additional anesthetic consultation (team led) was obtained in clinical decision-making apart from ventilator aspects. About 14% of respondents worked in such a setting.

Thirty-six percent of respondents worked in hospitals with rapid response teams, while 64% of respondents did not have this facility. A recent meta-analysis of 18 studies has revealed that rapid response systems (RRSs) are associated with reduced rates of cardiorespiratory arrest outside of the ICU and reduced mortality.^[23] Team training, communication between members, and crisis management were the critical aspects of an effective rapid response team.^[24] Institution of RRS needs to be considered where nonexistent.

Comparison of referral opinions across grades

These findings are consistent with the fact more critical emergency cases and high-risk elective cases being referred commonly to consultants. Measures for early referral of emergency surgical cases to anesthesia residents must be in place. Multidisciplinary team communications and preoperative optimizations need to be encouraged among residents. Residents worked with obstetric cases incompletely investigated and physicians who decided fitness for surgery. Clear protocols must exist for out of hours obstetric and

medical referrals and effective communication are important. No emergency surgical cases being brought to theater directly and no periarrest referrals in critical care with independent practitioners might reflect clustering of critical ill in university and teaching or super-specialty hospitals.

More consultants agreed for the presence of rapid response teams than residents. Barriers such as professional hierarchies are sometimes challenging to navigate and led to delays in care for patients whose condition was deteriorating. Underutilization and delays in activation of the RRT once predefined vital-sign derangements are met is associated with failure of RRTs.^[25] Failure of prompt activation may reflect reluctance by doctors and allied health professionals to go outside the traditional hierarchic model for referrals of clinical management (that is, junior nurse to senior nurse to junior physician to senior physician), even for acutely decompensating patients who meet criteria for RRT activation. These barriers must be recognized and addressed.

Intensive Care Unit types and ventilation referrals

In the anesthetist/intensivists-led ICU, 29% respondents agreed for referrals before respiratory compromise against 37% for after respiratory compromise. In ICUs led by team of physicians and anesthetists, these were 37% and 39%, respectively. However, in physician-led ICUs, 55% of respondents agreed for referrals after respiratory compromise compared to 29% agreeing for referrals before respiratory compromise [Table 3]. Thus, involving the anesthetist in clinical decision-making in physician-led ICUs may be beneficial.

Referral incidents, registry, and referral audits

Depending on their caseload and case mix, departments must periodically assess (by regular audit and research), whether subgroups of patients are being referred in line with current guidelines. Cancellations, critical incidents, and complications arising out of referral delays and improper referrals must be recorded as referral incidents.

We define a referral incident for a given clinical scenario as an event due to delayed or improper referral, which led to or which could have led to a different care pathway or worse clinical outcome than accepted standard practice, based on current guidelines or recommendations for that scenario. A separate referral incident registry must be maintained in

each department. Division of such registers to specific area of practice such as remote site - CT/MRI or obstetric services may be preferable. Each of these incidents must be discussed at the departmental and multidisciplinary, including nursing staff and surgeons or physicians where appropriate. Such discussions must lead to existing protocols being modified or new protocols being developed. Effective communication of such referral incidents and new or modified protocols to related surgical and medical departments is necessary for preventing repeat incidents and improvement of outcomes.

Regular referral audits must be encouraged comparing the current practice with set standards. These audits may focus on subgroup of patients such as emergency surgery or obstetric or specific areas such as preoperative high-risk case referrals.

Limitations

This is a cross-sectional survey, and we asked for the most common scenario rather than percentages of patients in the questions to make the questions as simple and straightforward as possible and to obtain a reasonable number of responses. For example, we asked for the most common scenario for referring a high-risk elective case rather than asking what percentage of cases are referred before admission. However, the most common scenario may more correctly estimate the actual scenario for each characteristic. There is also the possibility of overlapping of respondents from the same hospital. Nevertheless, this survey provides an insight into the referral services of anesthetic departments and develops the concept of Referral Incident reporting and recording such incidents in a referral incident registry and referral audits.

CONCLUSIONS

Anesthetic departments must periodically assess whether subgroups of patients are being referred in line with current guidelines. Cancellations, critical incidents, and complications arising out of referral delays and improper referrals must be recorded as referral incidents and a separate referral incident registry must be maintained in each department regular referral audits must be encouraged.

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Table 3: Comparison of Intensive Care Unit type and ventilation referrals for medical patients

Ventilation referral	ICU type						P
	Anesthetist/intensivists		Team physician-led and anesthetist		Physician-led		
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	
Routine anesthetist involvement	64 (29.49)	23.82-35.87	13 (22.41)	13.59-34.66	8 (9.52)	4.9-17.68	0.002
Referral before respiratory compromise	63 (29.03)	23.4-35.39	22 (37.93)	26.56-50.8	25 (29.76)	21.04-40.25	
Referral after respiratory compromise	81 (37.33)	31.17-43.93	23 (39.66)	28.09-52.51	47 (55.95)	45.3-66.07	
Periarrest referrals	9 (4.15)	2.2-7.7	0	0.0-6.21	4 (4.76)	1.87-11.61	

CI=Confidence interval, ICU=Intensive Care Unit

Conflicts of interest

There are no conflicts of interest.

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APPENDIX

Appendix 1: Questionnaire used for survey

Survey of perioperative and critical care referrals to anesthetists

Dear colleague,

This is a questionnaire regarding surgical and medical referrals.

Please **TICK ONLY ONE BOX** to indicate most common scenario in your hospital

1. What grade are you: Sir/Madam?
 - Teaching faculty/Consultant
 - Private practitioner
 - Postgraduate student.

2. How high-risk *elective* cases are informed to you?
 - Before admission for anesthetists opinion on optimization
 - Referred after admission but before deciding the date of surgery
 - After surgery date is fixed.

3. When you ask medical consultation for complicated cases?
 - Physician treats and leaves fitness to the anesthetist
 - Physician treats, but fitness is decided by the team of surgeon, anesthetist, and physician
 - Physician declares fitness and surgeon ask anesthetist to follow.

4. What is your opinion regarding preoperative resting echocardiogram for high-risk noncardiac surgery?
 - It will not improve outcome as a recent retrospective study has suggested
 - Will continue to ask ECHO till more evidence is available
 - It will help tailor my anesthetic technique for induction and anticipate complications intra- and post-operatively whatever the studies may say.

5. How emergency polytrauma and emergency laparotomies are informed?
 - For optimization soon after admission
 - After surgical time is already decided
 - Brought to the theater without prior information.

6. In the last year, how often have you optimized a high-risk emergency polytrauma/laparotomy *preoperatively* in the ICU?
 - ≥ 10 cases
 - 5–9 cases
 - 1–4 cases
 - None.

7. How Polytrauma and unconscious patients are referred from casualty/emergency?
 - Most are informed before arrival
 - Informed after arrival but as soon as recognized to need anesthetic intervention
 - Medical/surgical team attempts intubation/cannulation, anesthetist called later.

8. How high-risk emergency LSCS like PIH are informed to you?
 - Most are intimated soon after admission
 - Before shifting to theater but after full investigations such as platelets, coag.
 - Just before shifting and not investigated properly.

9. When do you participate in neonatal resuscitation in LSCS?
 - Pediatrician asks help when needed
 - I volunteer when pediatrician seems struggling
 - No pediatrician routinely and mostly managed by the anesthetist.

10. During neonatal resuscitation in LSCS, what help does the pediatrician require most commonly? (*tick only one*)
- Simple airway maneuvers
 - Intubation
 - Other _____.
11. How children requiring emergency CT/MRI/endoscopy are informed?
- As soon as decision to scan is made
 - Informed few minutes before shifting/after shifting
 - Informed from scan room when sedation attempts by pediatrician/others fails.
12. What kind of ICU you are working?
- ICU led by anesthetists/intensivists
 - Physician-led but anesthetists opinion considered in important clinical decisions
 - Physician-led and anesthetist involved in intubation and ventilator aspects only
 - Not involved in critical care.
13. How medical patients (e.g., pneumonia) requiring ventilation are informed?
- Anesthetist routinely involved even before intubation
 - Physicians inform about critically ill before respiratory compromise
 - Referral occurs only when respiratory compromise develops
 - Most are periarrest
 - Not involved in critical care.
14. Do you have medical emergency team or rapid response team for cardiac arrest in your hospital?
- Yes
 - No.
15. Any comments: _____



Thank you for your participation