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The Perioperative Outcome In Geriatric Patients Undergoing Major Gastrointestinal Surgery-A Prospective Observational Study

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Abstract

Background- The perioperative outcome in geriatric patients is a scarcely studied topic.The objective of this study was to identify the 30 day morbidity and mortality in geriatric patients undergoing major elective Gastrointestinal surgery and the predictive risk factors .

Methods-. We prospectively followed up 93 patients ,65 years and above .Their preoperative functional status was documented using the Katz Activities of Daily Livings ,Lawtons Instrumental Activities of Daily Livings,Clinical frailty scale , gait speed , timed up - go test and Charlsons comorbidity index.The 30 day morbidity comprised of Grade 2 and above Clavien Dindo complications.

Results - The 30 day mortality and the 30 day morbidity was 3.2% and 26.9% respectively. The morbidity predicting risk factors were prior history of falls, timed up - go test >14 seconds, significant weight loss ,malignancy and open surgeries.

Conclusion- Age is not an independent predictor of morbidity. Poor preoperative functional and nutritional status, malignancy and open surgeries carried increased risk.

Keywords: Age, Elderly, Gastrointestinal, Geriatric, Perioperative, Surgery

Introduction

According to the data from 'World Population Prospects' the 2019 revision ,by 2050,one in six people in the world will be over the age 65(16%).By 2050,one in four persons living in Europe and North America could be aged 65 or over. In 2018, for the first time in history, persons aged 65 or above outnumbered children under 5 years of age globally. The number of persons aged 80 years or over is projected to triple from 143 million in 2019 to 426 million in 2050.[1]Surgical disease in older adults is not identical to surgical disease in younger adults in a both physiologic and a psychosocial perspective. When the body is stressed, fewer reserves are available to meet the challenge precipitating organ failure or death.

Smith in 1907 stated very eloquently that "because(the patients) are old, we must not consider that it is time for them to die....We must endeavour to prolong life ,and prolong it with comfort". With this in mind, surgical decision making must focus on what is best for the older patient. However, the body of knowledge in the care of the elderly is relatively limited due to very few studies on this topic. Studies from the Western population by Finlayson et al, Dimick et al and so on have highlighted elevated

risks of overall morbidity and mortality for elderly patients undergoing Gastrointestinal surgeries[2,3.]

Moreover, there is significant differences among hospitals in outcomes for the elderly. Therefore, it is also important to understand what certain hospitals do to have better outcomes for elderly patients. Most of the studies done on the elderly are from western populations and there is an growing need to study the Asian population in this respect. Hence, this study plan was formulated which focused on the perioperative outcome in elderly patients undergoing major elective GI surgeries , identify specific complications for which older patients have significantly higher postoperative risk and also the risk factors contributing to the same. It shall also help in providing an answer to the age old question- Is age a contraindication for major surgery?

Materials and methods

Study design-

This is a single centre prospective observational study including 93 patients more than 65 years of age who underwent elective major gastrosurgery(which included upper GI ,colorectal and hepatopancreaticobiliary surgeries with duration more than 2hours) at the Department of Surgical Gastroenterology, KIMS HEALTH, Thiruvananthapuram, Kerala, India from February 2020 to September 2021.Patients having disseminated cancer, having preoperative mechanical ventilator dependence, having preoperative renal failure (acute or requiring dialysis),having an American Society of Anaesthesiologists class 5 status, or having preoperative sepsis or emergency surgeries or those patients not giving informed written consent were excluded from the study.

Sample size estimation

Formula for calculating sample size

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where,

p : Expected prevalence of morbidity

d : Absolute precision (range of CI)

Z : Desired Confidence level = (95%)at standard value of 1.96

(According to the similar study conducted by Bentrem etal,patients who underwent upper gastrointestinal tract(n=4115),hepatobiliary or pancreatic(n=3364) and colorectal(n=17268)operations at 121 hospitals between January 1,2005,andDecember 31,2006 were examined.[4]

30 day morbidity and mortality was

- 31.5% out of 4115 among Upper GIT surgeries

- 38.3% out of 3364 among Hepatopancreaticobiliary surgeries

- 31.4%out of 17268 among colorectal surgeries

total – 33.7% (overall morbidity & mortality for major GI surgeries) here)

Hence in our study, p = 33.7% (overall morbidity and mortality for major GI surgeries)

d = precision (10%)

Z = Desired Confidence level = (95%)

n = 82

Z - is standard normal variate (at 5% type I error $p<0.05$) it is 1.96 and at 1% type I error ($p<0.01$) it is 2.58. As in majority of cases, p values are considered significant below 0.05, hence 1.96 is used in the formula.)

The following variables were collected from the patients through direct questionnaires and from hospital charts: age ,sex, body mass index, albumin ,any prior history of falls, history of significant weight loss, degree of dependency using Katz ADLS, Lawtons IADLs, Clinical Frailty scale, Gait speed, Timed up go test, Charlsons comorbidity index and type of surgery(open, laparoscopic).Patients were followed up for 30 days in hospital and as outpatients. Information regarding whether a postoperative complication occurred was obtained from patient hospital charts and by contacting the patient directly if needed. Any decline in his preoperative functional status was also documented. The ICU length of stay hospital length of stay,30 day postoperative complications and 30 day mortality was documented.

The primary outcome in the study was to identify the 30 day morbidity and mortality following surgery where morbidity was defined as any one of the

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following:1.Delirium 2.Superficial SSI 3.Deep SSI including anastomotic leak 4.Wounddehiscence 5.Pneumonia 6.Pulmonary embolism 7.Re-intubation 8.Ventilatorsupport>48 hrs 9.Postoperative atelectasis 10.Acute Renal failure 11.Progressiverenal failure 12.Urinary Tract Infection 13.Dyselectrolytemia 14.CVA 15.Comafor longer than 24 hours 16.Peripheral nerve injury 17.Cardiac arrest 18.MI19.Pulmonary edema 20.Arrythmia 21.DVT 22.Systemic sepsis 23.Prolonged ileus 24.Readmission within 30 days after discharge 25.Re-exploration

These were also graded into 5 based on the Clavien Dindo Classification

The secondary outcome were the preoperative risk factors contributing to the 30 day morbidity and mortality .

Statistical analysis- Observed data was coded, tabulated and analysed using SPSSVersion 20 for Windows. Descriptive statistics was reported as frequency and percentages for categorical variables. Association between type of surgery and various clinical outcomes was done using Chi-square test. A binomial logistic regression was performed with presence/absence of complication as dependent variable and demographic and clinical factors as independent variables. Odds ratio calculated was expressed with 95% CI. A p-value of less than 0.05 was considered statistically significant.

Results

69(74%) males and 24 (26%)females comprised the study. Majority (44%) 41 patients belonged to the 65-69 year age group.45(48%) underwent HPB surgery,41(44%) underwent colorectal and 7(8%) underwent upper GI surgery. Majority of surgeries 64(69%) were laparoscopic and lap assisted surgeries.54(58%) cases were malignant.19(20.4%) patients had poor preoperative nutritional status with BMI<18.5 and /or albumin <3.5g/dl.29(31.2%) patients were dependent with ADL/IADL <2.30(32.3%) patients had CFS >3.44(47%) patients had gait speed <1m/s.77(83%) patients had TUG<14s.12(13%) patients reported prior history of falls.50(54%) patients had preoperative significant weight loss. 18(19%) patients had Charlsons Comorbidity Index less than 4.

The current population revealed a 3.2% 30 day mortality (3 out of 93 patients).30 day overall morbidity was 54(58.06%) out of 93 patients. Grade 2 and above Clavien Dindo surgical complication occurred in 25/93 patients-26.9%. There was increased risk of Grade 2 and above Clavien Dindo surgical complications in patients who had prior history of falls, who had timed up and go test more than 14 seconds, who had significant weight loss, who were operated for malignant causes and those who underwent open surgeries. The most common postoperative complication was postoperative SSI and post op dyselectrolytemia.16 (17%)patients developed postoperative superficial surgical site infection and 9(10%) developed deep wound infection including anastomotic leak. Among the 41 colorectal surgeries,15(36%) patients had only one post op complication and 6(15%) patients had more than 1 complication. Among the 45 HPB surgeries,15(36%) had only 1 post op complication and 12(27%) had more than 1 complication. Among the 7 upper GI surgeries,4(57%)had 1 post op complication and 2(28%) had more than 1 complication .

One patient acquired COVID infection postoperatively prolonging his ICU stay .4 patients required postop re-exploration. Other potential predictors like gender did not show any association with adverse postoperative outcomes. Majority of complications occurred in the 65-69 year age group .

A binomial logistic regression was done with presence/absence of any complication as outcome and clinical and demographic factors as predictors. In the presence of other factors, only malignancy had a statistically significant relation to complication. Patients with no malignancy had no complications(OR:0.27,p=0.034).

Table 1: Baseline patient characteristics

	type of surgery			Total
	Colorectal	**HPB**	**Upper**	

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				GastrointestinaI	
Gender	Males	25	38	6	69
	Females	16	7	1	24
Age group	65-69	12	26	3	41
	70-74	13	9	3	25
	75-79	7	7	0	14
	80 or more	9	3	1	13
Dependent (ADL 2 or/and IADL2)		17	10	2	29
Clinical Frailty Scale>3		15	13	2	30
Poor nutritional status(BMI<18.5 or /and Albumin <3.5)		6	12	1	19
Gait speed <1m/s		18	22	4	44
TUG <14s		34	37	6	77
Falls		3	9	0	12
Malignant		36	15	3	54
Weight loss		33	14	3	50
CCI<4		3	14	1	18
Lap/Open	Lap	29	28	4	61
	Open	9	17	3	29
	Lap assisted open	3	0	0	3

Figure 1:30 day mortality

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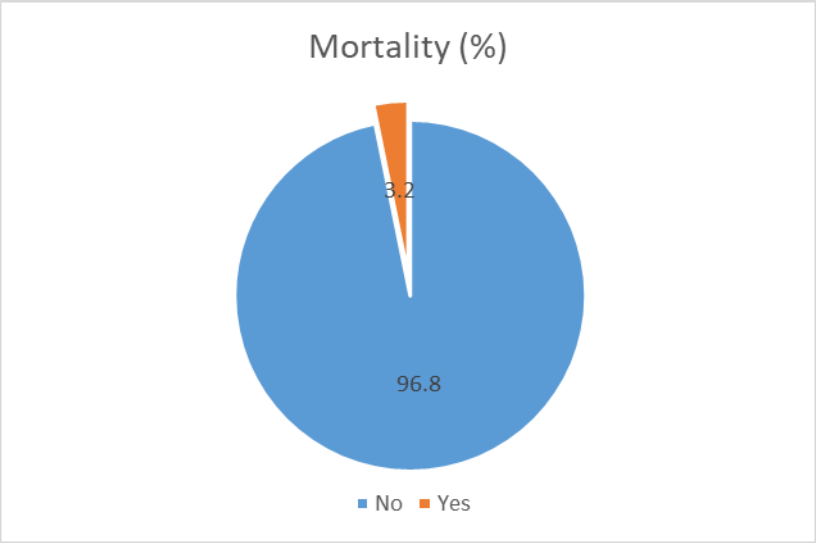

Table 2: Mortality by age group

		Age group				P -value
		65-69	**70-74**	**75-79**	**80 or more**	
mortality	No (n=90)	39	25	13	13	0.510
		95.1%	100.0%	92.9%	100.0%	
	Yes (n=3)	2	0	1	0	
		4.9%	0.0%	7.1%	0.0%	
Total		41	25	14	13	

Table 3: Overall morbidity by age group and type of surgery

Variable	**Colorectal**				**HPB**				**Upper GI**			
	65-69	**70-74**	**75-79**	**>80**	**65-69**	**70-74**	**75-79**	**>80**	**65-69**	**70-74**	**75-79**	**>80**
Pneumonia	0	0	0	1	1	0	0	0	1	1	0	0
>48 hours on ventilator	0	0	0	0	4	0	0	0	0	2	0	0
Required reintubation	0	0	0	0	1	0	0	0	0	0	0	0
Pulmonary embolism	0	0	0	0	0	0	0	0	0	0	0	0
Postoperative atelectasis	1	0	0	0	2	0	0	0	0	0	0	1
UTI	0	0	1	0	0	1	0	0	0	0	0	0
Acute renal failure	0	0	1	0	3	0	0	0	1	0	0	0

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Progressive renal failure	0	0	0	0	0	0	0	0	0	0	0	0
Dyselectrolytemia	1	2	1	2	6	3	1	0	0	0	0	0
MI	0	0	0	0	0	0	0	0	0	0	0	0
Pulmonary edema	0	0	0	0	1	0	0	0	0	0	0	0
Cardiac arrest	0	0	0	0	0	0	0	0	0	0	0	0
Arrhythmia	1	0	0	1	2	1	0	1	1	0	0	0
Deep wound infection including anastomotic leak	0	1	1	0	5	1	1	0	0	0	0	0
Superficial wound infection	3	2	2	4	4	0	1	0	0	0	0	0
Wound dehiscence	0	0	0	0	0	0	0	0	0	0	0	0
CVA	0	0	0	0	0	0	0	0	0	0	0	0
Coma>24 hours	0	0	0	0	0	0	0	0	0	0	0	0
Peripheral nerve injury	0	0	0	0	0	0	0	0	0	0	0	0
Delirium	0	2	1	1	5	1	0	0	1	0	0	0
Systemic sepsis	0	0	0	1	2	1	0	0	1	0	0	0
Bleeding requiring>4 units blood	0	0	0	0	2	0	0	0	0	0	0	0
Prolonged ileus	0	1	1	1	3	0	1	0	1	0	0	0
DVT	0	0	0	0	0	0	0	0	0	0	0	0
Readmission within 30days after discharge	0	0	0	0	2	0	0	1	0	0	0	0
Re-exploration	0	1	0	0	2	0	0	0	1	0	0	0

Table 4:Association between Grade 2 and above ClavienDindo surgical complications and variables

		ClavienDindo Grade		Total	p value
		< 2	>/= 2		
Type of surgery	Colorectal	34	7	41	0.438
		82.9%	17.1%	100.0%	
	Hepatopancreaticobiliary	29	16	45	

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		64.4%	35.6%	100.0%	
	Upper Gastr0intestinaI	5	2	7	
		71.4%	28.6%	100.0%	
Age group	65-69	28	13	41	0.706
		68.3%	31.7%	100.0%	
	70-74	20	5	25	
		80.0%	20.0%	100.0%	
	75-79	11	3	14	
		78.6%	21.4%	100.0%	
	80 or more	9	4	13	
		69.2%	30.8%	100.0%	
Gender	Males	49	20	69	0.154
		71.0%	29.0%	100.0%	
	Females	19	5	24	
		79.2%	20.8%	100.0%	
Nutritional status	Normal	60	14	74	0.266
		81.1%	18.9%	100.0%	
	Poor	8	11	19	
		42.1%	57.9%	100.0%	
Clinical frailty score	</= 3	49	14	63	0.392
		77.8%	22.2%	100.0%	
	> 3	19	11	30	
		63.3%	36.7%	100.0%	
History of falls	Yes	7	5	12	0.022
		58.3%	41.7%	100.0%	
	No	61	20	81	
		75.3%	24.7%	100.0%	
Dependant	0	49	15	64	0.216
		76.6%	23.4%	100.0%	
	Dependant	19	10	29	
		65.5%	34.5%	100.0%	
Gait speed	More than or equal to 1m/s	34	15	49	

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		69.4%	30.6%	100.0%	
	Less than 1m/s	34	10	44	0.142
		77.3%	22.7%	100.0%	
Timed up go test	14 or more	8	8	16	0.001
		50.0%	50.0%	100.0%	
	Less than 14	60	17	77	
		77.9%	22.1%	100.0%	
Loss of weight	No	36	7	43	0.009
		83.7%	16.3%	100.0%	
	Yes	32	18	50	
		64.0%	36.0%	100.0%	
Malignancy	Yes	34	20	54	0.032
		63.0%	37.0%	100.0%	
	No	34	5	39	
		87.2%	12.8%	100.0%	
CCI	4 or more	53	22	75	0.276
		70.7%	29.3%	100.0%	
	Less than 4	15	3	18	
		83.3%	16.7%	100.0%	
Lap/open	Lap	53	8	61	< 0.001
		86.9%	13.1%	100.0%	
	Open	12	17	29	
		41.4%	58.6%	100.0%	
	Lap assisted open	3	0	3	
		100.0%	0.0%	100.0%	

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Figure 2:Morbidity (%) based on Type of complication

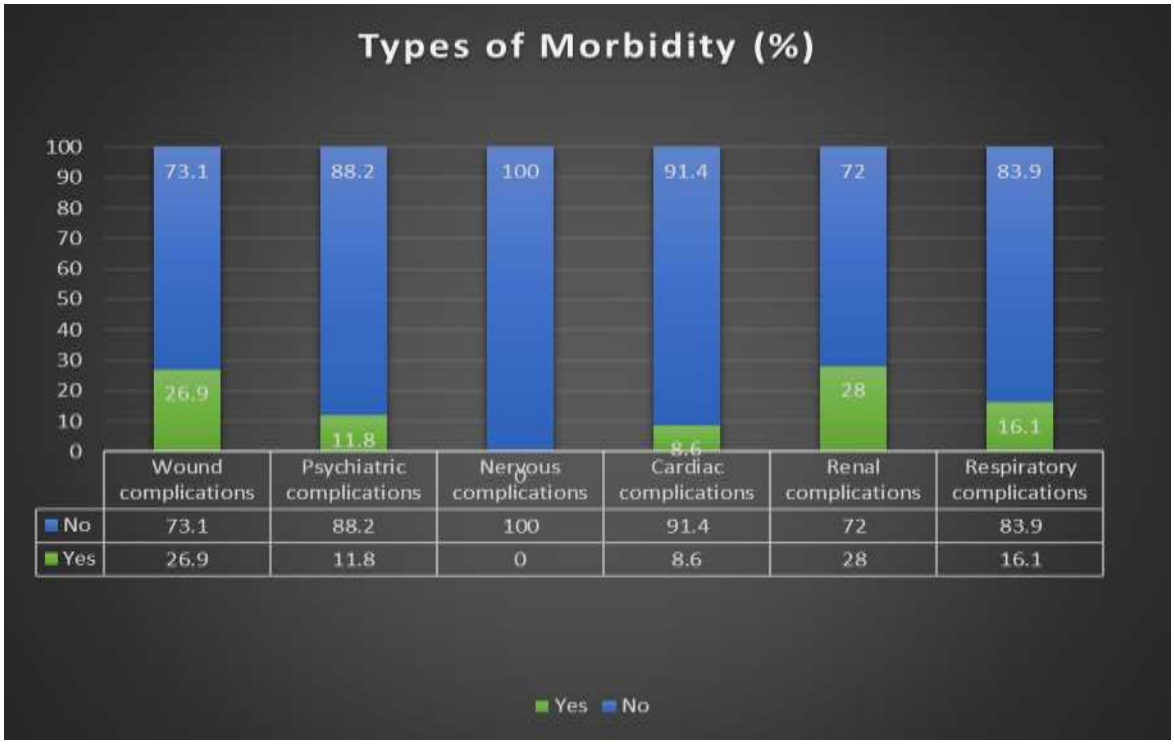

Table 5: Binomial logistic regression

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	107.188[a]	.187	.252
a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.			

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Gender	-.320	.649	.243	1	.622	0.726	.203	2.592
	Cardiac risk	.530	.916	.335	1	.563	1.699	.282	10.229
	dependent	.466	.724	.414	1	.520	1.593	.386	6.579
	Gaitspeed	.014	.545	.001	1	.980	1.014	.348	2.952
	Tug	-.697	.909	.588	1	.443	0.498	.084	2.956
	Falls	-.919	.869	1.118	1	.290	0.399	.073	2.191
	Clinical frailty score	.463	.601	.592	1	.442	1.588	.489	5.162
	Nutritional status	1.008	.734	1.885	1	.170	2.739	.650	11.540
	Malignancy	-1.278	.603	4.488	1	.034	0.279	.085	.909

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	CCI	.180	.706	.065	1	.799	1.197	.300	4.772
	Age group			2.644	3	.450			
	Age group (1)	-.263	.599	.193	1	.660	0.768	.237	2.487
	Age group (2)	-.038	.703	.003	1	.957	0.962	.243	3.818
	Age group (3)	-1.429	.883	2.618	1	.106	0.239	.042	1.353
	Constant	1.659	1.294	1.643	1	.200	5.253		

a- Variable(s) entered on step 1: gender, cardiac risk, dependant, gait speed, tug, falls, clinical frailty score, nutritional status, malignancy, CCI, age group.

Discussion

In this current study, a total of 93 geriatric patients undergoing major GI surgery was prospectively assessed. Also, the risk factors associated with the 30 day morbidity and mortality were analysed. The 30 day mortality in our study population was around 3.2%. and the overall 30 day morbidity (which included grade I-V Clavien Dindo classification)was 58.06%. Compared to literature, hospital mortality in our study group was relatively low at 3.2%.This may be explained by the policy of admitting the majority of the patients to the ICU after surgery and also probably because of good perioperative management and critical care support. This is consistent with the results of the EuSOS study in which 73% of the deaths occurred among patients who were never admitted to ICU and where postoperative mortality was lower in countries which had better provision of intensive care beds/better access to the ICU[8]. Also the majority of patients in our study had good preoperative nutritional status, were not dependent, had gait speed which was more than 1m/s, TUG less than 14 secs and no prior history of falls.

However, our results suggest that surgery in geriatric patients is not always benign as reflected by a 58.06% overall rate of postoperative complications. Grade 2 and above Clavien Dindo surgical complications were encountered in 25/93 patients-26.9%. There was increased risk of Grade 2 and above Clavien Dindo surgical complications in patients who had prior history of falls, who had timed up go test more than 14 seconds, who had significant weight loss, who were operated for malignant causes and those who underwent open surgeries. The most common postoperative complication encountered in our study was postoperative SSI and postoperative dyselectrolytemia. The chances of having wound infections in our study were more in those with preoperative significant loss of weight and those who were operated for malignant causes. Age was not found to be a predictive factor for SSIs in our study. These findings were similar to the prospective case control studies by Minutolo et al and Agodi et al regarding the surgical site infection in elderly vs younger patients undergoing abdominal surgeries. Their study reported no statistically significant differences between two groups in relation to age.[9,10].This was also substantiated by another cohort study by Kaye et al comprising of 144485 consecutive patients where surprisingly, at ages>=65 years, increasing age independently predicted a decreased risk of SSI.[11]

The chance of having respiratory complications were found to be more in upper gastrointestinal surgeries and those with CFS>3 in our study. This was comparable with the results of Cho et al in gastrectomy patients >=75 years ofage.[12]Our study however failed to show any statistically significant association between respiratory complications and open surgeries.In a review article by El-Sharkaway et al, it was concluded that age related pathophysiological changes in the handling of fluid and electrolytes make older adults undergoing surgery a high risk group and an understanding of these changes will enable better management of fluid and electrolyte therapy in the olderadult.[13]However,there was no statistically significant association with age and renal complications. Renal complications were more in those with poor preoperative nutritional status , those who underwent open surgeries and those with TUG test >14s.

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In a retrospective study by Liu et al in 547 patients aged above 80 years, who underwent non cardiac surgery,19.4% patients developed atleast one postoperative cardiac complication and 2.7% patients developed cardiac death. The risk factors were age more than 85 years, and BMI more than 30kg/m2.[14]Our study however showed contrary results with cardiac complications occurring more in those with poor nutritional status. Cardiac complications were also more in open surgeries, those with prior history of falls, those with TUG more than 14 s and those with poor nutritional status. In a retrospective study by Bai et al comprising 1351 patients, who underwent non cardiac surgery ageing had no influence on the perioperative cardiac risk inpatients without overt myocardial ischemia or infarction which was comparable to ourstudy[15].The 30 day follow up with a decline in his preoperative functional status was seen in those with gait speed more than or equal to 1m/sec and those who underwent open surgeries . The duration of ICU stay was longer in those with CFS more than 3, those who underwent surgeries for malignant cause, CCI more than 4,and those who underwent open surgeries. The length of stay was more in those with CFS more than 3, those with malignancy, significant LOW, CCI more than 4,and those who underwent open surgeries. This association regarding prolonged ICU and hospital stay in open surgeries was substantiated in a systematic review by Weber etal and another by Bates et al, which showed that despite underlying comorbid conditions, individuals older than 65 years tolerate laparoscopic procedures extremely well. They concluded that laparoscopic surgery is safe with shorter hospital stay and produces less morbidity and mortality and chronological age alone should not be considered contraindication in selecting patients for laparoscopic surgery[16,17].

In a systematic review by Hui shan et al, to identify the relationship between frailty and postoperative outcomes in surgical population with a mean age of 75 and older, frailty was associated consistently with increased 30 day ,90 day and 1 year mortality, postoperative complications and length of stay.[18]Our study results showed statistically significant association between frailty and prolonged stay. The chances of developing psychiatric complications were more in those with gait speed >1m/s and those who underwent open surgeries . Our study failed to show any statistically significant association between postoperative psychiatric complications with the preoperative functional and nutritional status. These findings were contradictory to the results of 228 patients by Sabha Ganai et al, which showed that poor preoperative functional and nutritional status correlated with postoperative delirium and mortality.[19]Age was found to be a strong risk factor for postoperative delirium in the studies by Marcantonio et al and Dyer et al. Our study however failed to show that age was a risk factor for POD.[20,21]

Wang et al in his study concluded that frail individuals with a high comorbidity index must be identified because they need targeted interventions pre- and postoperatively in terms of nutritional and functional optimisation to facilitate a smooth return to their preoperative functional status.[22]Our study produced similar results. The 30 day postoperative functional recovery was not associated with age .In our study, 30 day follow up with no decline in functional status was seen in those who underwent laparoscopic surgeries. On multivariate analysis, only malignancy had a statistically significant relation to postoperative morbidity.

The results indicate that adverse outcomes were more with poor preoperative nutritional and functional status. Laparoscopic surgeries under experienced hands carried lesser postoperative adverse outcomes. The limitations of our study include the lack of a control group which means the young patients <65 years of age , which would have enabled a direct comparison of the study group in terms of RRs and Odds ratio .Another was the smaller sample size of 93 patients compared to conclusions drawn from studies from large databases. Also, it covered almost all abdominal surgeries; both laparoscopic and open procedures ,both malignant and benign causes were taken in to consideration which makes it more diverse. Analysing and comparing the results has been difficult, as there were different surgical procedures and indications grouped together.

The strengths of the study was that it was a prospective study and covered a very important and scarcely studied topic. As the population ages there is increasing need to study the elderly population, recognize their needs and identify the factors which when modified can be used to improve their overall health . Most of the studies done on the elderly are

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from western populations and there is infact a growing need to study the Indian population. We believe that this study shall instill enthusiasm for future research on formulating new geriatric assessment tools to provide the best care to this age group.

Conclusion

Age is not an independent predictor of morbidity. Poor preoperative functional and nutritional status, malignancy and open surgeries carry increased risk.

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