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ORIGINAL ARTICLE

Efficacy of perioperative levosimendan on cardiac protection in patients undergoing coronary artery bypass surgery

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Abstract

Despite the reduction in perioperative mortality observed over the past two decades, the risk of performing cardiac surgery in patients with coronary artery disease and severe left ventricular dysfunction remains high, these risks have led to the appearance of several ways to provide better outcomes. These ways are either mechanical like intraaortic balloon pump (IABP) or using medical inotropic drugs either adrenergic (epinephrine, norepinephrine &dobutamine) or non-adrenergic (levosimendan) drugs. It is indicated for the short-term treatment of acutely

Patients and Method

Patients had collected, evaluated thorough the preoperative, intra-operative, postoperative period withpoor left ventricular function ejection less than or equal to 40%. Cases had allocated into two gatherings of 50 cases.cases had admitted to the cardiovascular intensive care unit (ICU) 24h before surgery, a peri-operative dose of continuous levosimendan infusion over a total of 24h in the other gathering, cases will be submitted to conventional inotropes only (non levosimendan gathering) according to their medical requirements.

Objective: the aim of this study had to detect the outcome of clinical use of preioperative Levosemindan for cases undergoing coronary artery bypass grafting with poor left ventricular function, also comparing it with the conventional medications as catecholamines.

Results

Gathering A included 38 cases received levosimendan as perioperative cardiac support Gathering B included 40 cases received conventional cardiac support. A critical difference between both gatherings regarding total operative time, total bypass time, failure of weaning from cardiobypass (C.P.B), the use of intraoperative I.A.B.P. There had a statistically critical difference between both gatherings in which C.V. P had lower in levosimendan. There had statistically critical difference regarding base critical in the levosimendan gathering. with high statistical difference for medical support, no difference for support.

Conclusion

the use of levosimendan perioperatively decrease the operative time, cross clamp time, facilitate the weaning from cardiomachine decrease the need of conventional inotropic support, decrease the duration of postoperative ventilation, improve the tissue perfusion, cardiac output parameters, length of I.C.U, hospital stay with decreasing early postoperative mortality, it had high degree of drug safety, tolerability

INTRODUCTION

Inspite of the advancement of interventional cardiacrevascularization techniques, coronary artery bypass graft surgeryischemic diseases remain a major challenge problem because the high incidence of the diseases specially the

cases with poor cardiac function, low cardiac output syndrome (**1)**Despite the reduction in perioperative mortality observed over the past two decades, the risk of performing cardiac surgery in cases with C.A.D, severe left ventricular dysfunction remains high, with developing postoperative complications. (**2)** These risks had led to the appearance of several ways to provide better outcomes. These ways are either like intraaortic pump (I.A.B.P) or using medical inotropic drugs either adrenergic or non-adrenergicdrugs. **(3)** The conventional inotropic adrenergic medication such as catecholaminesin the perioperative treatment of low cardiac output syndrome incases need cardiac surgery due to ischemic diseases can lead to arrhythmia, worsen the cardiac ischemia, increaseconsumption, decrease the renal blood flow **(1)** Levosimendan had a vasodilator, a pyridazone-dinitrite derivative. Its primary action had to enhance cardiac contractility. It had indicated for the short-term treatment of acutely decompensated severe chronic failure in situation where conventional therapy had not sufficient, in cases where inotropic support had considered appropriate. **(4)** Levosimendan had a calcium sensitizer had used recently for perioperative support in case undergoing C.A.B.G with impaired cardiac function. This medication used as inotropic agent without increase in the cardiac muscle oxygen consumption it also led to vasodilatation hens it had a cardiac protection in the perioperative period. **(5) (6)**It works by the opening of potassium channel gates through adenosine triphosphate cycle so itscritical in the treatment of the failure, cardiac support in the last 5 years had considered. **(7)**

Aim of the work

the aim of this study had to detect the critical, safety, outcome of clinical use of preioperative Levosemindan for cases undergoing coronary artery bypass grafting with poor left ventricular function, also comparing it with the conventional medications as catecholamines.

Patients &Methods

The study had done in the Cardiothoracic Surgery Department Zagazig University Hospital in the period between June 2018, September 2020.Seventy-eightcases had collected, evaluated thorough the preoperative, intra-operative, postoperative period especially the clinical pictures, left ventricular ejection fraction, duration of operative time, cross clamp time,cardiobypass time, ventilation, use of inotropes, I.C.U stay, hospital stay, morbidity, postoperative mortality. Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans. All cases present with coronary insufficiency confirmed by coronary angiographic reviews, pre-operative echocardiography revealed poor left ventricular function with ejection less than or equal to 40%. The cases had divided into two gatherings, Gathering A included 38 cases received levosimendan as perioperative cardiac support, while Gathering B included 40 cases received conventional adrenergic medication as for cardiac support. Old age cases more than 70 years old, cases with good left ventricular function more than 40% had excluded from the study, cases had admitted to the cardiovascular intensive care unit (I.C.U) 24h before surgery, had randomly assigned according to the medical record numbers to receive a peri-operative dose of continuous levosimendan infusion over a total of 24h with initial dose of 0.2 µg/kg/min for one hour, then the rate of 0.1 µg/kg/min (levosimendan gathering) for 23 hours, in the other gathering, cases will be submitted to conventional inotropes only (non levosimendan gathering) according to their medical requirements. For each case clinical assessment in the form of history taking, vital signs monitoring, investigations: C.B.C, kidney function test, liver function test, electrolytes daily. ABG daily. Cardiac enzymes daily, Cardiac functions with echocardiography to evaluate the left ventricular function. Coronary artery bypass grafting had done for each case, the number of grafts had taken according to the

preoperative decision depending on the angiography finding, other preoperative data .In postoperative period, all data had collected as The need for another inotropic agents beyond 24h after of primary one ,The need for post-operative circulatory assist devices (intra-aortic pump), the number of days with circulatory assist devices, the time needed for ventilation, the time of weening from it, duration of I.C.U stay ,duration of hospital stay ,postoperative mortality rate within two weeks of postoperative period .

STATISTICAL ANALYSIS

The collected data had coded, processed, analyzed using the SPSS (Statistical Package for Social Sciences) version 15 for Windows® (SPSS Inc, Chicago, IL, USA). Qualitative data had presented as number, percent. Comparison between gatherings had done by Chi-Square test. Quantitative data had tested for normality by Kolmogorov-Smirnov test. Normally distributed data had presented as mean ± SD. P < 0.05 had statistically critical.

RESULT

Our literature included seventy-eight cases with poor left ventricular ejection underwent cardiac surgery for C.A.B.G. The mean age in levosimendan gathering had 54.2±9.5 S.D, the mean B.M.I had 31.7±4.8. It included 63.2% males, 36.8% females. The mean age in conventional gathering had 56.9±10.2 S.D, the mean B.M.I had 29.9±3.2. It included 70% males, 30% females. There had no statistical significance difference between both gatherings regarding sex distribution, mean age or mean BMI (P=0.39, 0.75, 0.67 respectively). **(Table 1).** Regarding associated risk factor, the levosimendan gathering include 73.7% diabetic, 84.2% hypertensive, 55.3% had smoking history. The conventional gathering included 72.5% diabetics, 85% had hypertensive, 60% had smoking history. There had no statistical significance difference between both gatherings regarding D.M, H.T.N, smoking distribution (P value> 0.05). **(Table 2).** Regarding NYHA classification, the levosimendan gathering included 15cases (39.5%) with class II, 20cases (52.6%) with class III, 3cases (7.9%) with class IV while the conventional gathering included 17cases (42.5%) with class II, 20cases (50%) with class III, 3cases (7.5%) with class IV. There had no critical difference between both gatherings (P value 0.26). **(Table 3).** The mean operative time in gathering A had (341±27.6) while in gathering B had (411.2±33.4), The mean total bypass time had (95±15.3) in gathering A, in comparing to gathering B it had (124.3±22.4), the mean cross clamp time in minutes had in gathering A (64.7±12.6) meanwhile in gathering B had (68.3±10.1), the C.R.P first weaning failure in gathering A was14% but 30% in gathering B, while the second weaning failure from C.R.P had 8% in gathering A comparing to 18% in gathering B, the need of intra-aortic (I.A.B.P) had 18% in gathering B while 8% in gathering A. A critical difference between both gatherings regarding total operative time, total bypass time, failure of weaning from cardiobypass (C.P.B), the use of intraoperative I.A.B.P with P<0.05. There had no critical statistical difference as regards the cross-clamp time, the number of grafts used (p=0.45, 0.99 respectively). **(Table 4).** There had no statistically critical difference in the postoperative mean hemoglobin level, mean white blood count nor mean platelet count between the two-study gathering (P value 1, 0.269, 0.54 respectively). There had no statistically critical difference regarding postoperative alanine transaminase (A.L.T) level, aspartate transaminase (A.S.T) level between the two study gatherings (p=0.28, 0.537 respectively). There had no statistically critical difference regarding postoperative serum creatinine between the two study gatherings (p=0.484). There had no statistically critical difference between the two gatherings regarding postoperative I.N.R level (p=0.083). **(Table 5).** In our results the mean preoperative ejection had (37.1±2.1) in gathering A while in gathering B had (35.4±3.2) after C.A.B.G the

early postoperative ejection had (56.2±4.8) while in gatheringB had (54.7±5.8). from the analysis of both our preoperative, postoperative data the improvement in the ejection had higher in gathering B withoutcritical difference between both gatherings (P value =0.65). There had increase of postoperative rate withoutcritical difference in both gatherings (P value > 0.057),the mean preoperative rate had (82.8±7.2) in gathering A while in gathering B it had (83.7±7.8), the mean postoperative rate in gathering A had (101.3±15) but in gathering B had (114.5±23.7)The mean preoperative blood pressure had (121.7±16.4) in gathering A while in gathering B it had (127.3±19.6), the mean postoperative blood pressure in gathering A had (78.2±14) but in gathering B had (84.2±15.6)so there had decrease of postoperative blood pressure in both gatherings without critical statistical difference between both gatherings (P value > 0.057) Regarding the mean preoperative central venous pressure (C.V.P) had (10.8±4.2) in gathering A while in gathering B it had (10.6±5.7), the mean postoperative central venous pressure in gathering A had (10.5±3.9) but in gathering B had (16.2±7.2) There had a statistically critical difference between both gatherings in which C.V.P had lower in levosimendan gathering (P value=0.04, 0.03 respectively) **(Table 6).** There had statistically critical difference regarding base critical in the levosimendan gathering with mean base critical of 0.8±2.4 compared with the conventional gathering with mean base critical of -1.5±4.2 (p=0.018). Also, there had statistically critical higher mixed venous oxygen saturation in the levosimendan gathering compared with the conventional gathering at immediate (p=0.03). **(Table7).** The incidence of hypotension had higher in levosimendan gathering (36.8% versus 30%) but without significance between both gatherings (p =0.17). While the postoperative complications there had no critical difference between both gatherings for development of A.F, V.T, or V.F (p > 0.05). The use of additional inotropic support had less in the levosimendan gathering rather than conventional one (47.4% for medical, 5.3% for I.A.B.Pvs 67.5% for medical, 10% for I.A.B.P) with high statistical difference for medical support (P value 0.001), no difference for support (P value 0.4). The duration of ventilation in our study had a statistically big difference between the two gatherings (11±3.4.vs 18.7±4.5) in hours (P =0.04) which had more in gathering B, there had shorter duration with no critical statistical difference between both gatherings regarding length of I.C.U, hospital stay (P value >0.05). The mortality rate in gathering A had 14% versus 25% in gathering Bwith (P value 0.09). **(Table S1).**

Table (1): Comparison between both gatherings as regard to demographic data (n=78).

Variable		Levosimendan gathering (n=38)		Conventional gathering (n=40)		Test	P-value
		No.	%	No.	%		
Sex	Male	24	63.2	28	70	X^2=1.05	0.39 (NS)
	Female	14	36.8	12	30		
BMI (kg/m^2)	Mean±SD (Range)	31.7±4.8 (28-40)		29.9±3.2 (23-37)		t=0.223	0.67 (NS)
Age (years)	Mean±SD (Range)	54.2±9.5 (38-69)		56.9±10.2 (46-69)		t=0.747	0.75 (NS)

Table (2): Comparison between both gatherings as regard toassociated risk factors (n=78)

Variable		Levosimendan gathering (n=38)		Conventional gathering (n=40)		Test	P-value
		No.	%	No.	%		
DM	Yes	28	73.7	29	72.5	X^2=3.94	0.39 (NS)
	No	10	26.3	11	27.5		
HTN	Yes	32	84.2	34	85	X^2=3.12	0.57 (NS)
	No	6	15.8	6	15		
Smoking	Yes	21	55.3	24	60	X^2=2	0.26 (NS)
	No	17	44.7	16	40		

Table (3): Comparison between both gatherings regarding NYHAclassification (n=78)

NYHA classification	Levosimendan gathering (n=38)		Conventional gathering (n=40)		Test	P-value
	No.	%	No.	%		
NYHA II	15	39.5	17	42.5	X^2=2	0.26 (NS)
NYHA II I	20	52.6	20	50		
NYHA IV	3	7.9	3	7.5		

Table (4): Comparison between both gatherings regarding intra-operative data (n=78).

Variable		Levosimendan gathering (n=38)	Conventional gathering (n=40)	P-value
Total operative time (min)	Range	250-360	264-480	<0.001 (HS)
	Mean±SD	341±27.6	411.2±33.4	
Total bypass time (min)	Range	68-132	٦٨-١٧٤	<0.001 (HS)
	Mean±SD	٩٥±١٥.٣	١٢٤.٣±٢٢.٤	
Cross clamping time (min)	Range	٤٦-٧٨	٤٨-٨٧	0.45 (HS)
	Mean±SD	64.٧±12.6	٦٨.٣±١٠.١	
Grafts number	Mean	3±1	3±1	0.99 (HS)
C.R.P weaning failure	First weaning failure, n(%)	7 (14%)	15 (30%)	0.01 (HS)
	Second weaning failure, n(%)	4 (8%)	9 (18%)	0.03 (HS)
I.A.B.P	Intraoperative	4 (8%)	9 (18%)	0.03 (HS)

Table (5): Comparison between both gatherings as regard to the postoperative laboratory finding (n=78).

Variable		Levosimendan gathering (n=38)	Conventional gathering (n=40)	Test	P-value
		Mean±SD	Mean±SD		
Complete blood count	**Hb**	11±1.2	9.8±1.9	t=0	1(NS)
	PLT	174.8±36.2	180.4±58	t=0.617	0.54(NS)
Liver profile	**ALT (u/l)**	53.2±49.6	74.1±79.8	t=1.09	0.28(NS)
	AST (u/l)	54.7±59.8	73±89.7	t=0.622	0.537(NS)
Renal function	**Serum creatinine**	2±1.1	2.2±1.5	t=0.706	0.484(NS)
Coagulation profile	**INR**	1.1±0.2	1.2±0.3	t=1.77	0.083 (NS)

Table (6): Comparison between both gatherings as regard to hemodynamics, left ventricular ejection fraction(n=78).

Variable		Levosimendan gathering (n=38)	Conventional gathering (n=40)	Test	P-value
		Mean±SD	Mean±SD		
Ejection (%)	preoperative	37.1±2.1	35.4±3.2	t=1.323	0.822 (NS)
	Postoperative	56.2±4.8	54.7±5.8	t=1.543	0.65 (NS)
blood pressure	preoperative	121.7±16.4	127.3±19.6	t=3.122	0.12 (NS)
	Postoperative	78.2±14	84.2±15.6	t=2.86	0.17 (NS)
rate	preoperative	82.8±7.2	83.7±7.8	t=1.853	0.75 (NS)
	Postoperative	101.3±15	114.5±23.7	t=1.95	0.057 (NS)
Central venous pressure (C.V.P)	preoperative	10.8±4.2	10.6±5.7	t=5.12	0.04 (NS)
	Postoperative	10.5±3.9	16.2±7.2	t=3.23	0.03 (NS)

Table (7): Comparison between both gatherings regarding base critical, mixed venous oxygen saturation in both gatherings (n=78).

Variable	Levosimendan gathering (n=38)	Conventional gathering (n=40)	Test	P-value
	Mean±SD	Mean±SD		
Base critical	0.8±2.4	-1.5±4.2	t=2.6	0.018 (SS)
Mixed venous oxygen saturation	68.7±6.9	63.8±7.8	t=2.23	0.03 (SS)

DISCUSSION

Inotropic medication as catecholamine had used in the perioperative period for cardiac support in case with impaired left ventricular function undergoing Coronary artery bypass grafting with low cardiac output syndrome for controlling the intraoperative, postoperative complication. **(8)**

Many literatures concluding the positive effect of levosimendan forperioperative periodof coronary artery bypass grafting with impaired left ventricular function due to its inotropic effect with decreasingthe myocardialoxygenconsumption, improving the renal blood flow. **(9,10)** Our literature included seventy-eightcases with poor left ventricular function undergoing cardiac surgery for C.A.B.G. In gathering A,63.2% had males, 36.8% had female with mean age (54.2 +/- 9.5 years). while in gathering B,70% had males, 30% had female with mean age (56.9 +/- 10.2 years). With no critical difference between the two gatherings.The mean BMI had 31.7 +/- 4.8 in gatheringA while in gathering B 29.9 +/- 3.2 with no critical difference between the two gatherings.The associated co-morbidity in bothgatherings including DM, smoking, hypertension had no critical difference between both gatherings.In the NYHA classification, both gatherings had dyspnea from grade 2 to grade 4 with no critical difference between two gatherings.The mean operative time in gathering A had (341±27.6) while in gathering B had (411.2±33.4), The mean total bypass

time had (95±13.5) in gathering A, in comparing to gathering B it had (123.4±24.2), the mean cross clamp time in minutes had in gathering A (64.7±12.6) meanwhile in gathering B had (63.8±11), the C.R.P first weaning failure in gathering A was14% but 30% in gathering B, while the second weaning failure from C.R.P had 8% in gathering A comparing to 18% in gathering B, the need of intra-aortic (I.A.B.P) had 18% in gathering B while 8% in gathering A.The analyzing of the intra operative data mentioned above we denoted critical increase in the operative time, total bypass time, cross clamping time, the failure from cardiomachine, the need of intraoperative intra-aortic had critically increase in gatheringB comparing to gathering AThe same result concluded by many authors as R.Levin et.al evaluated the perioperative use of levosimendan in cases under went C.A.B.G with poor left ventricular function giving 10mic/kg in 10min, a maintenance dose of levosimendan in 23 hours by a dose of 0.1mi/kg/min, he found the intra operative complications had critically decreased as the low cardiac output syndrome, he concluded the levosimendan had an important in the perioperative period for decreasing the intraoperative time cross clamp time, the need of intra-aortic balloon**. (11, 12)**. Severi et.al went hand by hand with our result, the result of R.Levin et.al, he concluded that the levosimendan had superior over the conventional medication in perioperative stage of cases undergoing cardiac surgery with poor cardiac function.**(8,12)**. RavikumarGandham et al evaluated 60 cases underwent mitral valve surgery, compared the critical of levosimendan, dobutamine for cardiac support in the perioperative period,he recorded the operative time, cross clamp time, weaning from cardio-bypass machine, he concluded that the conventional inotropic support had superior over the levosimendan gathering, this difference between our result may be due to the lower age of cases with mitral valve diseases who need mitral valve surgery, the severity of left ventricular dysfunction in ischemic diseases are more than mitral valve diseases**.(7,13)**.In our literature the mean preoperative ejection had (37.1±2.1) in gathering A while in gathering B had (35.4±3.2) after C.A.B.G the early postoperative ejection had (56.2±4.8) while in gathering B had (54.7±5.8). from the analysis of both our preoperative, postoperative data the improvement in the ejection had higher in gathering B withoutcritical difference between both gatherings (P value =0.65). I.Husedzinovic et.al evaluated the critical of Levosimendan as a new medication for C.A.B.G during off pump in 24 cases received either placebo or levosimendan at a dose of 12mic/kg as an infusion for 15 min before C.A.B.G. At 10 min, 60 min post-infusion, the ejection had evaluated he noticed criticalimprovement in postoperative ejection of levosimendan gathering than with conventional gatherings (P=0.018 each), critical increase in the stroke volume for levosimendan gathering. **(14, 15)**. Rajendrah.Mehta.et.al studied 880 cases, evaluated the critical of levosimendan in cases with poor cardiac function underwent open surgery, he found critically improve in the postoperative ejection fraction, cardiac output (p value<0.0001), the same result concluded that levosimendan improve the postoperative cardiac function in comparing to the use of conventional medication. **(16, 17,18)**. In our study, we found increase of postoperative rate without critical difference in both gatherings (P value > 0.057), the mean preoperative rate had (82.8±7.2) in gathering A while in gathering B it had (83.7±7.8), the mean postoperative rate in gathering A had (101.3±15) but in gathering B had (114.5±23.7).The mean preoperative blood pressure had (121.7±16.4) in gathering A while in gathering B it had (127.3±19.6), the mean postoperative blood pressure in gathering A had (78.2±14) but in gathering B had (84.2±15.6)so

there had decrease of postoperative blood pressure in both gatherings without critical statistical difference between both gatherings (P value > 0.057). Our results regarding to rate, blood pressure corresponding to the study done by PolychronisMalliotakis et al, contrary to the study obtained by RavikumarGandham et al. they showed critical statistical difference in both rate, early postoperative blood pressure in comparing levosimendan gathering with other conventional gatherings (P Value >0.05).also,Julian Alvarez et al stated that there had a critical mean early blood pressure, rate difference between both gatherings at 6, 48 hrs.postoperatively (P value <0.05)**(1, 7, 19)**. In our literature the mean preoperative central venous pressure (C.V.P) had (10.8±4.2) in gathering A while in gathering B it had (10.6±5.7), the mean postoperative central venous pressure in gathering A had (10.5±3.9) but in gathering B had (16.2±7.2). We found a statistically critical difference between both gatherings in which C.V.P had lower in levosimendan gathering (P value=0.04, 0.03 respectively) Julian Alvarez et al found that critical difference in central venous pressure at 6, 48 hours postoperatively in both gatherings with (p<105). **(1, 20)**. In ourstudy, we depend on thebase critical, mixed venous oxygen saturation as indicators for cardiac output, tissue perfusion, the mean postoperative base critical in gathering A had (0.8±2.4) while in gatheringB had (-1.5±4.2), the mixed venous oxygen saturation in gathering A had (68.7±6.9) but in gathering (63.8±7.8), from the analysis of the previous data. There had a statistical significance between both gatherings from the aspect of base critical, mixed venous oxygen saturation (P value 0.018). Julian Alvarez et al concluded that there had acritical difference in both base critical, mixed venous oxygen saturation in both gatheringat 6, 48 hoursafter cardiac surgeryfor C.A.B.G with (P value<0.05). **(1, 20)**. Al shawaf et.al reported a study of 30 case underwent coronary artery bypass graft, he found a critical high in cardiac index with increase in mixed venous oxygen saturation with levosimendan gathering (p value<0.05), critical in lower capillary wedge pressure, vascular resistance. **(2,21)**. In our literature the incidence of hypotension had higher in levosimendan gathering (36.8% vs 30%) but without significance between both gatherings (p =0.17). This occurred after using a loading dose or when used after development of low cardiac output syndrome. The use of additional inotropic support had less in the levosimendan gathering rather than conventional one (47.4% for medical, 5.3% for I.A.B.Pvs 67.5% for medical, 10% for I.A.B.P) with high statistical difference for medical (P value 0.001), no difference for support (P value 0.4). The same results concluded by R. Levin et al showed that the levosimendan treated gathering showed lower requirement for other inotropes compared to conventional gathering (7.9% vs 58.4%; P value=0.05), for vasopressors (14.2% vs 45.6%; P value=0.05). **(5, 12)**. In a randomized, placebo-controlled trial, P. Lahtinen, colleagues had found that 15 % of cases in the levosimendan gathering versus 58% in the placebo gathering experienced postoperative failure, hence less requirement of vasopressors (P <0.001). **(10, 16)**. In our study, there had no critical difference between both gatherings regarding the development of A.F, V.T, or V.F (p > 0.05). Santilloet al. compared the critical, safety of levosimendan, dobutamine in acute myocardial dysfunction. In the levosimendan gathering, cases had more likely to experience atrial fibrillation (P =0.05) with non-critical difference in developing ventricular tachycardia (p =0.67), while Harrison et al. included 1,155 cases from 14 randomized trials, they had found a critical reduction in the postoperative incidence of atrial fibrillation in cases treated with levosimendan. **(20)**. The duration of ventilation in our study had a statistically big difference between the two gatherings

(11±3.4.vs 18.7±4.5) in hours (P =0.04) which had more in gathering B. This had expected because of the higher rate of I.A.B.P use, the more frequent events of L.C.O.S, the more need for inotropes in this gathering. Similar data had reported by Toller et al. in a study involved 106 cases where levosimendan gathering showed lower myocardial injury, decreased time on the ventilator. **(16, 21)**. In our literature, we found shorter duration with no critical statistical difference between both gatherings regarding length of I.C.U, hospital stay (P value >0.05). This incritical result regarding the length of I.C.U, hospital stay as we preferred to keep the cases in I.C.U, hospital for a matter of safety for close observation. Toller et al. concluded that, short course of management bylevosimendan reduce the tracheal intubation time, decreased requirement for inotropic support, thus a shorter duration of I.C.U, hospital stay. The same concluded by Tasouli et al. who compared 45 cases with L.C.O.S treated with levosimendan, conventional medication. The study showed better results in those who had treated earlier with levosimendan, had a short time on inotropic support, a lower incidence of sepsis, a shorter I.C.U, hospital stay. **(20,21)**. In our study the mortality rate in gathering A had 14% versus 25% in gathering Bwith (P value 0.09). We noted the most of mortality rate had a difficulty of weaning from C.P.B. The same result reported by Tasouli et al who found a critical reduction in the mortality with early use of levosimendan in cardiac case. **(13, 20)**. In contralaterally to our study, obtained by Chan P et.al. had meta-analysis of 25 study including 2960 casesshowed that allmortality rate had 6.4% in the levosimendan gathering, 8.4% in the conventionalgathering, recent meta-analysis by Lee et al. included nine reviewsof total 1950 cases, reported thatthe 30-days mortality, long-term mortality indicated that levosimendan reduced mortality but not to the statistical significance (p> 0.05). **(17, 20)**

CONCLUSION

The cases undergoing C.A.B.G with poor cardiac function, in which L.V. ejection had less than 40% the use of levosimendan perioperatively decrease the operative time, cross clamp time, facilitate the weaning from cardiomachine decrease the need of conventional inotropic support, decrease the duration of postoperative ventilation, improve the tissue perfusion, cardiac output parameters, length of I.C.U, hospital stay with decreasing early postoperative mortality, it had high degree of drug safety, tolerability. Further study needed for the critical of levosimendan in different type of cardiac surgery.

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Supplementary file

Table (S1): Comparison of postoperative finding in both gatherings (n=78).

The duration of ventilation in our study had a statistically big difference between the two gatherings

Variable		Levosimendan gathering (n=38)	Conventional gathering (n=40)	P-value
Arrhythmia	Atrial fibrillation (AF)	10 (26.3%)	10 (25%)	0.57 (NS)
	Ventricular tachycardia (VT, VF)	6 (15.8%)	8 (20%)	0.4 (NS)
Hypotension (systolic blood pressure <80mmHg)		14 (36.8%)	12 (30%)	0.17 (NS)
Use of postoperative inotropic support	Medical	18 (47.4%)	27(67.5%)	0.001 (HS)
	(I.A.B.P)	2(5.3%)	4(10%)	0.4 (NS)
Duration of ventilation (in hours)	Range	7-54	7-68	0.04 (HS)
	Mean±SD	11±3.4	18.7±4.5	
Length of I.C.U stay (in days)	Range	2-8	2-6	0.67 (NS)
	Mean±SD	3.7±1.2	4.8±1.7	
Length of hospital stay (in days)	Range	5-18	4-15	0.73 (NS)
	Mean±SD	8.4±1.5	9.5±2.8	

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