COMPARISON OF POSTOPERATIVE ANALGESIA BETWEENULTRASOUND GUIDED PARAVERTEBRAL BLOCK AND UNILATERALSPINAL ANAESTHESIA IN PATIENTS UNDERGOING OPEN INGUINALHERNIA REPAIR

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Abstract

Introduction - The emergence of ultrasound imaging in regional anaesthesiahas revolutionizedthepopularityofPNBs.Itprovidesveryhigh-resolutionimages,direct visualization of structures, avoid accidental vessel or nerve injuries and hence providehigh safetyprofileascomparedtoblindprocedures.Thisleadstoincreasedsuccessrateduetoreal timeimagingwhilethedrugisbeinginjected,decreaseddoseneededforlocalanaestheticsand hence reduced the risk of local anaesthetictoxicity.

Methodology-ThestudywasdoneastheRandomizedSingleBlindedComparativeStudy. Patientsundergoingunilateralinguinalherniarepairwerechosen.Thepatientswererandomly allocated into two groups such as group S (Unilateral Spinal Anaesthesia) and groupP (Paravertebralblock),of25patientseach,usingblockrandomizationwithsealedenvelope system.

Results-Wefoundthatthemeanarterialpressurewasbetterpreservedinthepatientsreceiving PVBascomparedtounilateralspinalanaesthesia.However,heartratewascomparableinboth techniques. PVB provides better postoperative analgesia as time to first rescue analgesiawas significantly higher and total rescue analgesia consumption was significantly less in groupP. No significant difference was found in adverse effects in bothtechniques.

Keywords - spinal anaesthesia, Paravertebral block, Unilateral SpinalAnaesthesia

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1.0Introduction

Inguinalherniaisdefinedasprotrusionofabdominalcavityanditscontentsthrough theinguinalcanal.Itisamongthemostprevalentoftheabdominalwallhernias,comprisingof virtually75%ofcases,withalifetimeriskof27%inmenand3%inwomen.InIndia,the annualprevalenceis1,957,850.Repairsofgroinherniaarecommonlyperformedbygeneral surgeons second only to appendectomy in both adults and children, out of which 95% arethe inguinal hernias. Most common method is the open meshplasty due to its less recurrencerate andshortprocedurewhichcanbedoneonoutpatientbasis.Itisaprovenfactthatneither hernia type nor the repair technique has influence in postoperative pain relief scores, whilethe mode of anaesthesia influencesit.

ExperienceswithPeripheralNerveBlocks(PNB)foringuinalherniarepair,reveala distinct advantage over all the other techniques like GA,SA, Unilateral SA and local anaesthesia(LA).Theydecreasetheneedforextensivepost-anaesthesiacareunit(PACU),and PONV. In addition, PNBs also ensure the quicker post-operative ambulation hencepromotes day care surgery and better post-operative painrelief.

ParavertebralBlock(PVB),whichisavarietyofPNB,wasfirstperformedbyHugo SellheimofLeipzigin1905,wassupportedandreinforcedsubsequentlybyLawen(1911)and Kappis (1919), and gained swift popularity in the early part of the twentieth century, butlater declined and was practically abandoned because of frequent adverse events[16,17]. PVBsshare the characteristics features of both neuroaxial block and unilateral spinal hence it is more appropriate to call them as ‘paraspinal’ or ‘paraneuraxial’ epiduralblock[20].

Theemergenceofultrasoundimaginginregionalanaesthesiahasrevolutionizedthe popularity of PNBs. It provides very high-resolution images, direct visualization ofstructures, avoid accidental vessel or nerve injuries and hence provide high safety profile as comparedto blind procedures. This leads to increased success rate due to real time imaging while thedrug isbeinginjected,decreaseddoseneededforlocalanaestheticsandhencereducedtheriskof localanaesthetictoxicity[26].Furtheritreducesthetimetoperformtheblockduetodirect visualization.

This study was designed to compare ultrasound guided paravertebral blockwith unilateralspinalanaesthesiafortheduratonofpost-operativeanalgesia(primaryoutcome), andincidenceofadverseeventsnamelypost-operativenauseaandvomitingandurinary retention (secondary outcome). There are many studies comparing landmark techniqueof paravertebralblockwithunilateralspinalanaesthesiaforinguinalherniarepair.However,very fewstudiescomparing*ultrasoundguided*paravertebralblockwithunilateralspinalanaesthesia in the patients undergoing inguinal herniarepair.

Hence, this study was designed to compare USG guided paravertebral blockand *unilateral* spinal anaesthesia to evaluate duration of post-operative analgesia inpatients undergoing open inguinal herniarepair.

2.0. MaterialsMethods

2.1. Study details and sample size

This study was planned as the randomized single blinded comparative study.Patients undergoingunilateralinguinalherniarepairwaschosenasstudypopulation.Theminimum requiredsamplesizewith90%powerofstudyand5%levelofsignificanceis21patientsin each study group. So total sample size taken is 50 (25 patients pergroup).

2.2. Inclusion and exclusioncriteria

Malepatientsbetween18-65yearswhoareundergoingelectiveunilateralopeninguinal herniarepairwiththephysicalstatusASAIandIIwereincludedinthestudy.Patientswith morbidobesity(BMI>35kg/m^2),coagulopathy,historyofsubstanceabuse,allergytolocal anaesthesia,mentaldysfunctionandcontraindicationtospinalanaesthesiawereexcludedfrom the study.

2.3. Block Randomization with Sealed envelopesystem

Inthis,tenrandomlygeneratedtreatmentallocationswerepreparedwithinsealed opaque envelopes assigning P and S in 5 envelopes each, where P represents Groupreceiving paravertebralblockandSrepresentsGroupreceivingunilateralspinalanaesthesia.Oncea patienthadconsentedtoenteratrialanenvelopewasopenedandthepatientwasofferedthe allocatedgroup.Inthistechnique,patientswererandomizedinaseriesofblocksoften.The observerwasnotawareofwhichblockhe/shewasobservingsinceboththeblocksweregiven same dressing making the study singleblinded.

2.4. Methodologyfollowed

Thepatientswererandomlyallocatedintotwogroups,of25patientseach,usingblock randomization with sealed envelope system.

1. GROUP S (Unilateral SpinalAnaesthesia)
2. GROUP P (Paravertebralblock)

Depending on the group allocated, the patient was explained the procedure indetail.

Afterreceivingpatientinoperationtheatrethemultichannelmonitorwasconnected and baseline vitals were recorded like heart rate (HR), systolic blood pressure(SBP),diastolic bloodpressure(DBP),meanarterialpressure(MAP)andoxygensaturation(SpO_2).An18G cannula wassecured.Vitals weremonitoredthroughouttheprocedure.Allthepatients receivedIVmidazolam0.02mg/kgbefore theblocktoreducethestressandanxietyduringthe placement of theblock.

2.5.USG guided PVB block longitudinal out of planeapproach

After positioning the patient, under aseptic precautions the cephalad aspect ofthe spinousprocessesofT10wasmarked.Theprobewasplacedlongitudinally5-10cmsaway from the midline to identify the rounded ribs and parietal pleura underneath. Abdominal pre-set,Depth9-12cm,Curvedarraylinearprobe(4-8MHZ)wasused.Thetransducerwasthen movedprogressivelymoremediallyuntiltransverseprocesseswereidentifiedasmoresquared structured and deeper to the ribs. Once the transverse processes were identified, a 22G,80mm ultrasoundneedlewasinsertedout-of-planetocontactthetransverseprocessandthenwalkoff the transverse process 1-1.5 cm. Then, after the negative aspiration of blood andcerebrospinal fluidwiththehelpoftheextensionlineconnectedtoneedleforUltrasoundguidedblock (Sheathedcatheteroverneedlewithsidechannelforlocalanaestheticinjection)salinewas injectedandobservedforhydrodissectionandanteriordisplacementofpleura.Injectionof 15mlof0.5%BupivacainewasnowgivenafterrulingoutbloodandCSFinaspiration.This resulted in anterior displacement of the parietalpleura.

FortheblockatL1level,thetransducerwaspositionedapproximately4cmlateral fromthemidlineattheleveljustcephaladtotheiliaccrestanddirectedslightlymediallyto assume a transverse oblique orientation. This approach allowed imaging of thelumbar paravertebralregionwiththepsoasmajor,erectorspinae,andquadratuslumborummuscles, thevertebrallaminaandtheanterolateralsurfaceofthevertebralbody.Theneedlecouldbe insertedlaterallyormediallytothetransducer.Then,afterthenegativeaspirationofbloodand cerebrospinalfluidwiththehelpoftheextensionlineconnectedtoneedleforUltrasound guided block (Sheathed catheter over needle with side channel for local anaestheticinjection) salinewasinjectedandobservedforhydrodissection.5mlof0.5%Bupivacainewasthen injected after negative aspiration for blood and CSF.

2.6.Statisticalanalysis

ThedatawasenteredinMSEXCELspreadsheetandanalysiswasdoneusingStatistical Package for Social Sciences (SPSS) version 21.0. Quantitative variables were comparedusing independentttest/Mann-WhitneyTest(whenthedatasetswerenotnormallydistributed) betweenthetwogroups.Pairedttest/Wilcoxonsignedranktestwasusedtocomparepre-operativeandintraoperativefindingswithinthegroup.Qualitativevariableswerecompared using Fisher's exact test. p value of <0.05 was considered statisticallysignificant.

3.0. Results andDiscussion

3.1. Comparison of age in years between group S andP

No significant difference was seen in the distribution of age in years between groupS andP.(pvalue>.05)Agegroupwas18to30yearsof32%inSand12%inPand51to60 yearswas32%ofpatientsinSand12%ofpatientsinP.Proportionofpatientswithage group 61-70 years was 12% of patients in S and 32% of patients in P. Age group was 31-40 yearsin very few patients; 16% of patients in S and 12% of patients in P with no significantdifference in distribution betweenthem.

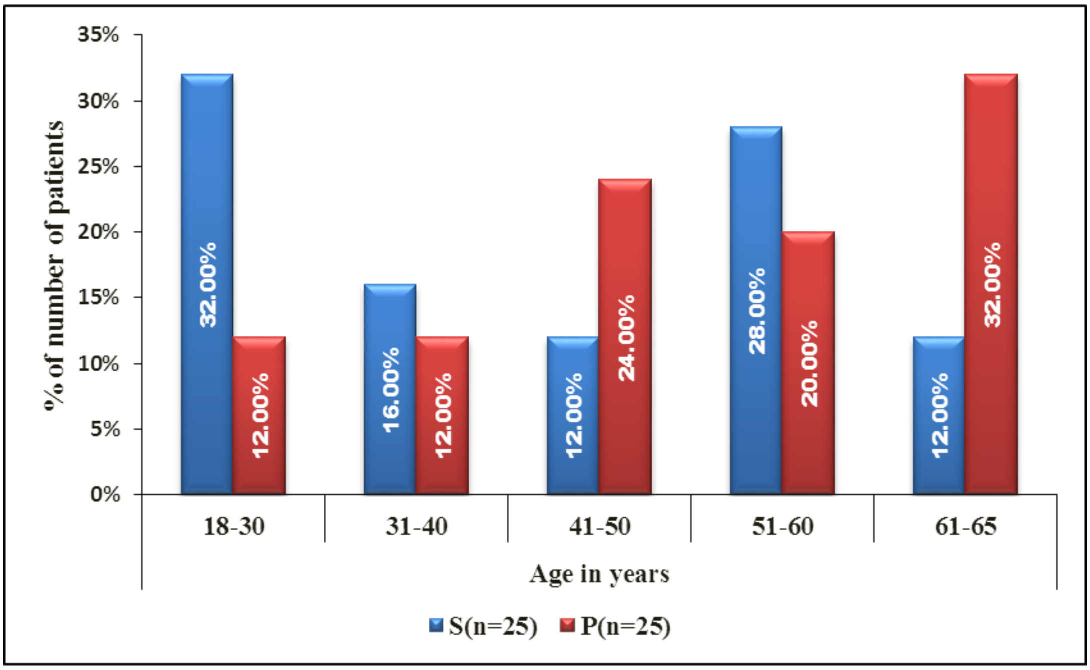


Figure 1:-Comparison of age in years between group S andP

The variable age in years was not normally distributed. Thus non-parametric test was usedfor the comparison. No significant difference was seen in age in years between group S and P.(p value >.05) Median (IQR) of age in years in S was 46(28.25-58) and P was 54(43-62) withno significant difference between them. It is shown in Figure1.

3.2. Comparison of total IV fluids requirements (in millilitres) between group S andP

The variable total IV fluids requirements (in millilitres) was notnormally distributed. Thusnon-parametrictestwasusedforthecomparison.Significantdifferencewasseenintotal IVfluidsrequirements(inmillilitres)betweengroupSandP.(pvalue<0.0001)Median(IQR) oftotalIVfluidsrequirements(inmillilitres)inSwas1390(1200-1500)whichwas significantlyhigherascomparedtoP(990(915-1067.5)).TheBox-and-Whiskerplotdepicts thedistributionoftotalIVfluidsrequirements(inmillilitres)inthe2groups.Themiddle horizontallinerepresentsthemediantotalIVfluidsrequirements(inmillilitres),theupperand lower bounds of the box represent the 75th and the 25th centile of total IV fluidsrequirements (inmillilitres)respectively,andtheupperandlowerextentofthewhiskersrepresentthe maximum and the minimum total IV fluids requirements (in millilitres) in each of thegroups. It is shown in Figure2.

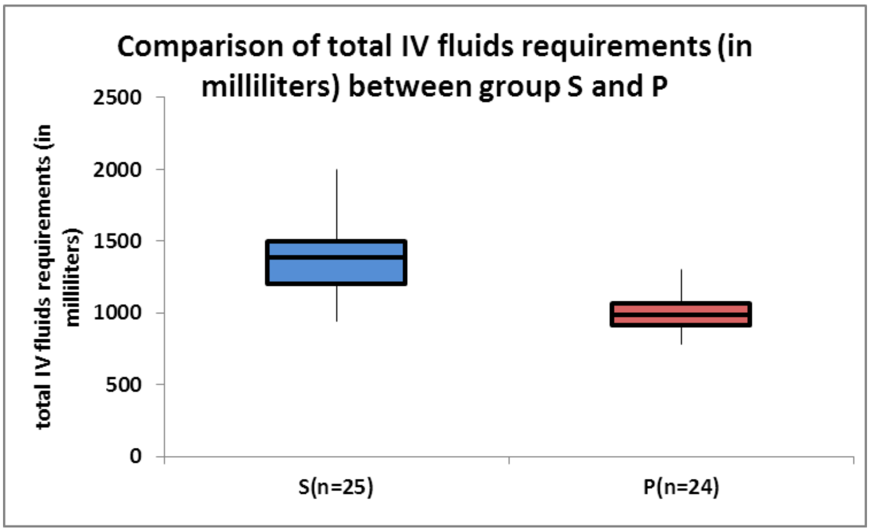


Figure 2 - Comparison of total IV fluids requirements (in milliliters) between groupS and P(non-parametric variable, Box-whiskerplot)

3.3.Comparisonofdecreaseinheartrate(bpm)intra-operativelybetweengroupSand P

Thevariablepre-operativeheartratewasnormallydistributed.Thusparametrictest was used for the comparison. No significant difference was seen in pre-operative heart rate betweengroupSandP.(pvalue>.05)Mean±SDofpre-operativeheartrateingroupSwas 75.56 ± 7.3 and in group P was 77.5 ± 9.08 with no significant difference between them. The variable intra-operative heart rate was normally distributed. Thus parametric test was usedfor thecomparison.Nosignificantdifferencewasseeninintra-operativeheartratebetweengroup SandP.(pvalue>.05)Mean±SDofintra-operativeheartrateingroupSwas68.76±7.04 and in group P was 71.62 ± 7.82 with no significant difference betweenthem.

Nosignificantdifferencewasseenindecreaseinheartrate(bpm)intra-operativelybetween groupSandP.(pvalue>.05)Median(IQR)ofdecreaseinheartrate(bpm)intra-operatively ingroupSwas8(5-9)andingroupPwas8(4-12)withnosignificantdifferencebetweenthem. The Box-and-Whisker plot depicts the distribution of decrease in heart rate (bpm) intra-operativelyinthe2groups.Themiddlehorizontallinerepresentsthemediandecreaseinheart rate (bpm) intra-operatively, the upper and lower bounds of the box represent the 75th andthe 25thcentileofdecreaseinheartrate(bpm)intra-operativelyrespectively,andtheupperand lowerextentofthewhiskersrepresentthemaximumandtheminimumdecreaseinheartrate (bpm) intra-operatively in each of thegroups.

Table 1 - Comparison of mean arterial pressure (mmHg) between group S andP

Mean arterial pressure(mmHg)	S (n=25)	P (n=24)	Total	P value	Test performed
Pre-operative					
Mean ± SD	80.08 ± 7.58	83.25 ± 7.85	81.63 ± 7.8	0.156	t test;1.439
Median(IQR)	80(75-85)	84.5(77.5-90)	82(76-89)		
Range	64-93	68-94	64-94		
Intra-operative					
Mean ± SD	69.72 ± 5.69	78.08 ± 8.79	73.82 ± 8.43	0.0003	t test;3.936
Median(IQR)	70(66-72)	82(69.75-86)	71(68-82)		
Range	60-83	65-90	60-90		
Decrease in mean arterial pressure intra-operatively					
Mean ± SD	10.36 ± 3.39	5.17 ± 4.16	7.82 ± 4.57	<0.0001	t test;4.802
Median(IQR)	10(9-13)	6(3-8.25)	9(4-10)		
Range	3-17	-5-10	-5-17		

3.4.Comparisonofdecreaseinmeanarterialpressureintra-operativebetweengroupS and P (parametricvariables)

The variable pre-operative mean arterial pressure was normally distributed.Thus parametrictestwasusedforthecomparison.Nosignificantdifferencewasseeninpre-operative mean arterial pressure between group S and P. (p value>.05) Mean ± SD of pre-operative mean arterial pressure in group S was 80.08 ± 7.58 and in group P was 83.25 ±7.85 with no significant difference betweenthem.

The variable intra-operative mean arterial pressure was normally distributed. Thusparametric testwasusedforthecomparison.Significantdifferencewasseeninintra-operativemean arterialpressurebetweengroupSandP.(pvalue<0.0001)Mean±SDofintra-operativemean arterialpressureingroupPwas78.08±8.79whichwassignificantlyhigherascomparedto group S (69.72 ±5.69).

The variable decrease in mean arterial pressure intra-operatively was normallydistributed. Thus parametric test was used for the comparison. Significant difference was seen indecrease inmeanarterialpressureintra-operativelybetweengroupSandP.(pvalue<0.0001)Mean± SD of decrease in mean arterial pressure intra-operatively in group S was 10.36 ± 3.39which was significantly higher as compared to group P (5.17 ± 4.16). It is shown in Table2.

3.5.ComparisonofdurationofsurgerybetweengroupSandP(non-parametric variables)

The variable time to perform block (in mins) was not normally distributed. Thusnon-parametrictestwasusedforthecomparison.Significantdifferencewasseenintimetoperform block(inmins)betweengroupSandP.(pvalue=0.001)Median(IQR)oftimetoperform block(inmins)ingroupPwas14(12.75-16)whichwassignificantlyhigherascomparedto group S(7(6-8)).

Thevariabletimetosurgicalanaesthesia(inminutes)wasnotnormallydistributed.Thusnon-parametrictestwasusedforthecomparison.Significantdifferencewasseenintimetosurgical anaesthesia(inminutes)betweengroupSandP.(pvalue<.05)Median(IQR)oftimeto surgical anaesthesia (in minutes) in group P was 22(19-24.25) which was significantlyhigher as compared to group S(9(8-11)).

The variable duration of surgery (in minutes) was not normally distributed. Thusnon-parametric test was used for the comparison. No significant difference was seen in durationof surgery(inminutes)betweengroupSandP.(pvalue>.05)Median(IQR)ofdurationof surgery (in minutes) in group S was 76(67-92) and group P was 80(69.75-91) withno significant difference between them.

Thevariabledurationinoperatingroom(inminutes)wasnormallydistributed.Thusparametric testwasusedforthecomparison.Significantdifferencewasseenindurationinoperatingroom (in minutes) between group S and P. (p value <.05) Mean ± SD of duration in operatingroom (in minutes) in group P was 114.79 ± 12.97 which was significantly higher as comparedto group S (102.52 ±14.1).

TheBox-and-Whiskerplotdepictsthedistributionofnon-parametricvariablesinthe2groups. Themiddlehorizontallinerepresentsthemedian,theupperandlowerboundsofthebox representthe75thandthe25thcentilerespectively,andtheupperandlowerextentofthe whiskers represent the maximum and the minimum in each of thegroups.

Table 2 - Comparison of operating room parameters between group S andP

Operating room parameters	S (n=25)	P (n=24)	Total	P value	Test performed
Time to perform block (in minutes)					
Mean ± SD	6.6 ± 1.61	14.62 ± 3.81	10.53 ± 4.97	<.0001	Mann Whitney test;5.5
Median(IQR)	7(6-8)	14(12.75-16)	9(7-14)		
Range	4-10	8-26	4-26		
Time to surgical anesthesia (in minutes)					
Mean ± SD	9.56 ± 1.78	22.04 ± 3.54	15.67 ± 6.88	<.0001	Mann Whitney test; 0
Median(IQR)	9(8-11)	22(19-24.25)	13(9-22)		
Range	6-13	17-29	6-29		
Duration of surgery (in minutes)					
Mean ± SD	80.04 ± 14.71	82.33 ± 13.59	81.16 ± 14.07	0.528	Mann Whitney test;268.5
Median(IQR)	76(67-92)	80(69.75-91)	80(69-92)		
Range	60-110	60-110	60-110		
Duration in operating room (in minutes)					
Mean ± SD	102.52 ± 14.1	114.79 ± 12.97	108.53 ± 14.78	0.002	t test;3.167
Median(IQR)	100(90-111)	111(106-122)	110(96-119)		
Range	84-132	96-144	84-144		

3.6. Comparison of Bromage score between group S andP

Significantdifferencewasseeninthedistributionofbromagescorebetweengroup SandP.(p value<.05)Bromagescorewas3in100%ofpatientsingroupSwhichwassignificantlyhigher ascomparedto0%ofpatientsingroupP.Bromagescorewas0,1and2in8.33%,33.33%and 58.33% of patients in group P respectively which was significantly higher as compared to0% of patients in group Seach.

3.7. Comparison of trend of NRS scores atdifferent time intervals between group S and P.

ThevariableNRSscoringwasnotnormallydistributed.Thusnon-parametrictestwasusedfor the comparison. No significant difference was seen in NRS scoring at 2 hours, at 12 hours,at 24 hours between group S and P.(p value >.05) Median(IQR) of NRS scoring at 2 hours, at12 hours, at 24 hours in group S was 3(3-4), 4(3-4), 3(2-3) and in group P was 3(2.75-4),4(3-4), 3(2-4)respectivelywithnosignificantdifferencebetweenthem.Significantdifferencewas seeninNRSscoringat4hours,at6hoursbetweengroupSandP.(pvalue<.05).Median(IQR) of NRS scoring at 4 hours in group S was 7(7-8) which was significantly higher ascompared to group P (3(3-4)). Median (IQR) of NRS scoring at 6 hours in group P was 7(6-7.25)which was significantly higher as compared to group S (4(4-4)). It is shown in table 10, figure10.

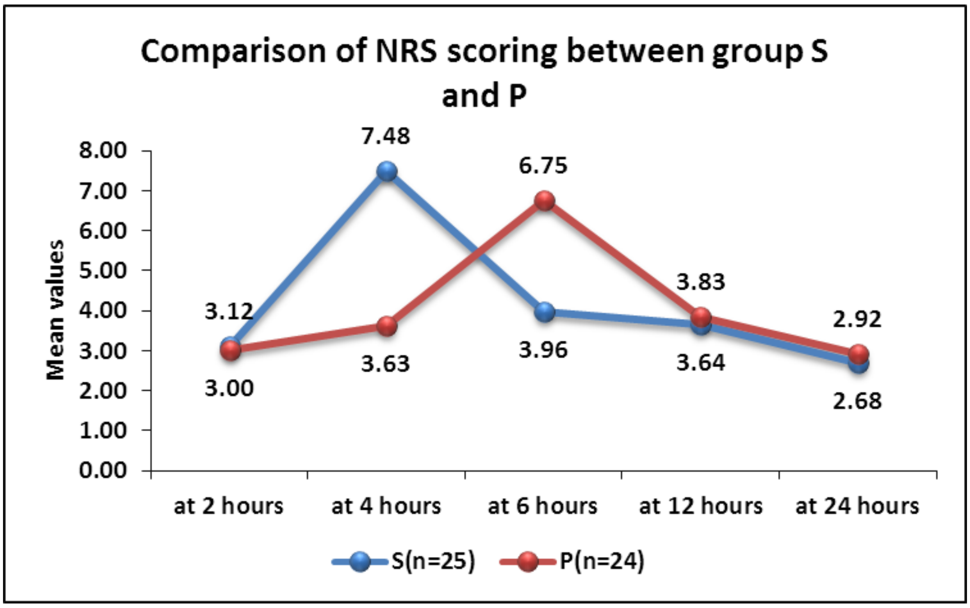


Figure 3 - Comparison of trend of NRS scores at different timeintervals between group S andP

3.8. Comparison of time to first rescue analgesia (in minutes) between group Sand P.(non-parametric variable, Box-whiskerplot)

Thevariabletimetofirstrescueanalgesia(inminutes)wasnotnormallydistributed.Thusnon-parametrictestwasusedforthecomparison.Significantdifferencewasseenintimetofirst rescue analgesia (in minutes) between group S and P. (p value <.05) Median (IQR) of timeto firstrescueanalgesia(inminutes)ingroupPwas368(352-379.25)whichwassignificantly higher as compared to group S (253(244-262)). The Box-and-Whisker plot depictsthe distributionoftimetofirstrescueanalgesia(inminutes)inthe2groups.Themiddlehorizontal linerepresentsthemediantimetofirstrescueanalgesia(inminutes),theupperandlower boundsoftheboxrepresentthe75thandthe25thcentileoftimetofirstrescueanalgesia(in minutes) respectively, and the upper and lower extent of the whiskers represent themaximum and the minimum time to first rescue analgesia (in minutes) in each of thegroups.

244

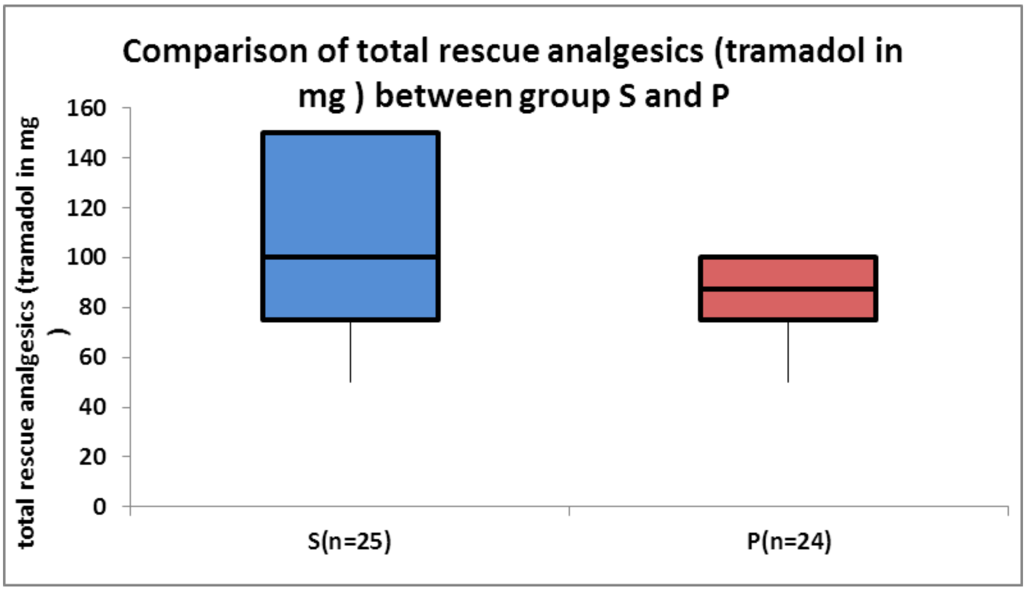


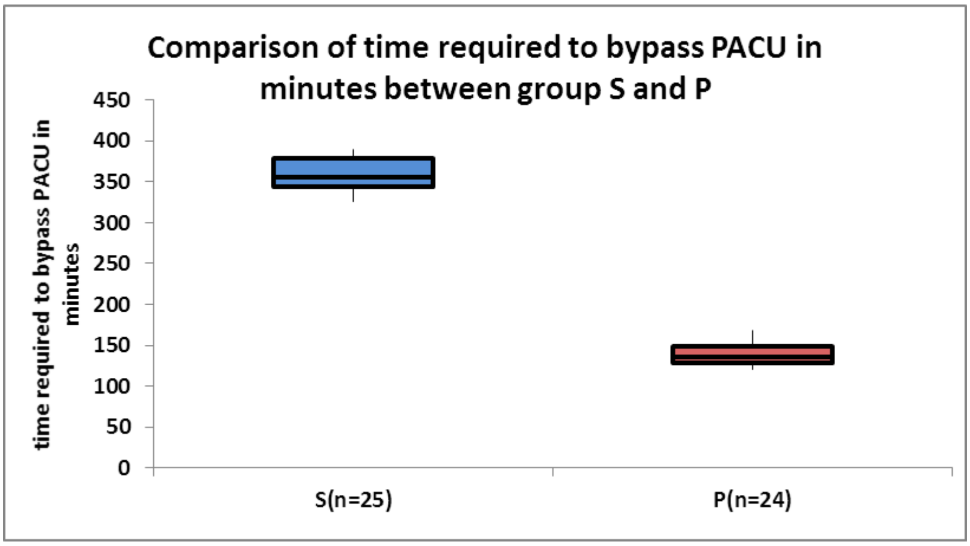
Figure 4 - Comparison of total rescue analgesics (tramadol in mg) between group Sand P (non-parametric variable, Box-whiskerplot)

3.9. Comparison of urinary catheterisation between group S andP

Significant difference was seen in the distribution of urinary catheterisation between groupS andP.(pvalue<.05)Urinarycatheterisationwasnotrequiredin76%ingroupSwhichwas significantly lower as compared to 100% in group P and was required in 24% of patients inS as compared to 0% of patients inP.

3.10. Comparison of time required to bypass PACU in minutes (modified aldretescoring ≥ 9) between group S and P (non-parametric variable, Box-whiskerplot)

The variable time required to bypass PACU in minutes (modified aldrete scoring ≥ 9) wasnotnormallydistributed.Thusnon-parametrictestwasusedforthecomparison.
Significant difference was seen in time required to bypass PACU in minutes between groupS andP.(pvalue<.05)Median(IQR)oftimerequiredtobypassPACUinminutesingroupS was355(344-378)whichwassignificantlyhigherascomparedtogroupP(135.5(129-149.25)).
TheBox-and-WhiskerplotdepictsthedistributionoftimerequiredtobypassPACUinminutes inthe2groups.Themiddlehorizontallinerepresentsthemediantimerequiredtobypass PACUinminutes,theupperandlowerboundsoftheboxrepresentthe75thandthe25thcentile oftimerequiredtobypassPACUinminutesrespectively,andtheupperandlowerextentof thewhiskersrepresentthemaximumandtheminimumtimerequiredtobypassPACUin minutes in each of thegroups.



245

Figure 5 - Comparison of time required to bypass PACU in minutes (modifiedaldrete scoring ≥ 9) between group S and P.(non-parametric variable, Box-whiskerplot)

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4.0.CONCLUSION

Inconclusion,PVBcanberecommendedasabetterandsafealternativetounilateralspinal aesthesia for inguinal hernia repair as it provides unilateral and segmentalanaesthesia, prolongedpostoperativeanalgesia,earlyambulation,stableintraoperativehemodynamics,and minimal adverse effects. But, the main concerns are one needs to develop goodunderstanding of ultrasound imagery and acquire skills of USG guided nerve block which require goodhand eyecoordination.Thiswouldsurelyreducethetimetakentoperformtheblockandhence popularize thebloc

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