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Subarachnoid Block In Lateral Decubitus Position Using 1ml,2ml And 3ml Of 0.5% Heavy Bupivacaine For Lower Limb Surgeries--Comparison Between Dependent(DL) And Nondependent Limb(NDL) For Onset, Highest Sensory Level And Duration Of Spinal Block

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Abstract :
Introduction :*Subarachnoid block using local anesthetics is choice of anesthesiafor lower limb surgeries .We conducted study on 75 patients 25 each group of 1,2 and 3ml of 0.5% heavy bupivacaine(8% glucose) for spinal anesthesia in lower limb surgeries. We compared effect of spinal block between dependent limb and non dependent limb after giving spinal anesthesia in lateral decubitious position.*
Aim: *To study and compare dependent with nondependent limb fortime taken for onset, highest sensory dermatomal level and duration of recovery of subarachnoid block in lateral decubitious position using different volumes of 0.5% heavy bupivacaine in patients posted for lower limb surgeries.*
Material and method:*75 patients between 18 to 80 yrs of age undergoing lower limb surgeries lasting for 90 to 120 minutes were selected. Informed consent of the patients were taken.Randomisedtothree different groups of 1ml,2ml and 3ml of heavy 0.5% bupivacaine.Spinal anesthesia was given in lateraldecubitious position with operating limb on dependent side. Pinprick method was used for assessing sensory block and Bromage's scale used for motor assessment.We assessed time taken for onset of subarachnoid block, highest level of sensory block and time for recovery from subarachnoid block and were recorded. Then we compared effect of spinal block between dependent and nondependent limb..*
Results: *Demographically all three groups were comparable.For comparison of means of two groups. Student't' was used and comparison of frequencies within group 'X^2'(Chi square)test was used.Nostatistically significant difference foundin onset ofsensory and motor block between dependent and non-dependent side in all groups(p value->0.05).There was no statistical significant difference in highest dermatomal sensory level between dependent and nondependent side in all the groups, which was contrary to the observation, may be due to small sample size of study(p value->0.05). There was statistical significant difference in duration of both sensory and motor block between dependent and nondependent side(p value-<0.05)*
Conclusion: S*pinal anesthesia when given in lateral decubitious position there isnosignificant difference in onset of spinal anesthesia between dependent and nondependent limb. Contrary to observation this study showed no difference between dependent and nondependent limb in highest sensory dermatomal level of block may be due to small sample size. There is significant difference between both limbs in duration of sensory and motor block.*

Keywords –*Subarachnoid block, lower limb surgeries, dependent limb,nondependent limb*

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I. Introduction

Spinal anesthesia though previously going out of vogue in many countries now came back and is widely used in India. The many advantages of spinal anesthesia for surgery below the diaphragm are well-known and widely accepted.The main reasons for the wide use of spinal anesthesia in our country are undoubtedly the shortage of anesthetic equipment's,the prohibitive cost of cylinders,gases and the scarcity of the trained anesthesiologists. Later the introduction of newer local anesthetics such as procaine,tetracaine,lignocaine,bupivacaine,mepivacaine etc. resulted in betterand safer anesthesia.In the pastthe chief disadvantage has been the unpredictable time element with the subarachnoid blockade.This prevented its wider acceptance inspite of its obvious advantages to the surgeon, namely complete relaxation, in particular. Another such disadvantage restricting its acceptance is consciousness of the patient during surgery.But with the

newer local anesthetics, using refined modern techniques and use of sedatives/anxiolytics or even 'light' general anesthesia,these disadvantages are almost negated[1].

Effect of subarachnoid block depends on multiple factors, one of it is positon of the patient during subarachnoid block[2].Hyperbaric bupivacaine try to sink at place of injectionand the spread is limited [3].Subarachnoid block with hyperbaric 0.5% Bupivacaine: Effect of volume by Anelsson K. H., used 1. 5, 2, 3, 4ml of 0.5% of Bupivacaine with 8% dextrose[4]. Maximal cephalad spread is directly related to the volume of solution injected in aubarachnoid space.Subarachnoid block with hyperbaric Bupivacaine:Effects of volume of solution bySundnls K. O. et alshowedincreased volume increased the extent of motor blockade and speeds up the onset of sensory blockade[5].Dose- response study of Bupivacaine in subarachnoid block bySheskey et al, showed duration of sensory analgesia at T10-12 dermatomes was longer in patients receiving either 15 or 20 mg of Bupivacaine, than in patients given 10 mg. The dose is important than the volume or concentration employed[6].Positon of patient do have effect on spinal block[4].Purpose of this study was to see effect of lateral decubitious position on spinal anesthesia tocompare effect on dependent(DL) and nondependent limb(NDL) in respect to onset , highest level of sensory block and duration of spinal recovery.

II. Materials And Method

This randomized study of comparison between dependent and nondependent limb using 1ml,2ml and 3ml of 0.5% bupivacaine for subarachnoid block was carried out in patients scheduled for lower minor limb surgeries. Patients were selected where expected surgical time was between 90 to 120 min. Surgeries planed were like wound debridement ,skin grafting, k-wire fixation,#patellaORIF,diagnostic arthroscopy ,amputation, secondary suturing,. All patients belonged to group I or II according to the ASA classification of physical status. Patients with spinal deformities,mentaldisorders, local skin infection, significant neurological disorders,coagulation disorder or refusal for spinal anaesthesia were excluded from the study.

Routine investigations hemoglobin, complete blood count, serum creatinine,chest X-ray and in patients above 40 years of age or with relevant complaints electro-cardiogram were obtained. Also serum electrolytes, liver function tests and other relevant test were obtained wherever indicated.Total 75 patients were selected for the study. They belonged to either sex, their ages varied between 20 and 80 years, and their heights between 148 and 178cms.Patients selected for the study were randomised in three groups, according to the dose used for spinal anaesthesia with 0.5% Bupivacaine hydrochloride (heavy-8% glucose),

Group A - 1 cc of O.5% Bupivacaine.
Group B - 2 cc of O.5% Bupivacaine.
Group C - 3 cc of O.5% Bupivacaine.

During preoperative visita day prior to surgery patient consent was taken after explaining the surgical procedure, anesthesia plan and its complications.General examination,airway ,spinal examination, other systemicexamination done and confirmed within normal limit.In preoperative area reassessment of patient, confirmation of surgical site, surgical plan, starvation, cross match of blood done and consent for anesthesia and surgery checked.

An intravenous line was secured in forearm with 18 or 20 gauge cannula. An intravenous drip with Ringer lactate was started and adequate preloading of 10ml/kg was given. No sedative was given as a pre-medication so as to get full co-operation of the patient for assessment of onset of sub-arachnoid block.

All routine monitors like(NIBP),electrocardiogram(ECG),pulse oximetry(SPO2),temperature monitors attached, baseline parameters noted.Sub-arachnoid block was given to all patients lateral decubitious position with operative side down by midline approach after cleaning the back withtaking all aseptic precautions.A 25 gauge Lumber puncture needle(Quincke's-B Braun Medical Inc.) was used ,0.5 % Bupivacaine (heavy-8% glucose) – 1cc, 2cc or 3cc was taken in a five ml syringe. The drug was taken at operating room temperature.The bevel of the needle was kept lateral during the lumbar punctureand injected in the same direction in L3-L4 space. The rate of injection was approximately 0.2 ml/s,given after free dribbling of CSF from spinal needle without aspirating it to prevent dilution and patient kept in lateral position until fixation of the block.The spread of subarachnoid block was tested with blunt pinprick and motor movement of joints every 5 minutes using Bromage'sscalefrom 0 to 4 (0 = able to move hip, knee, ankle,toes; 1 = unable to move hip, able to move knee,ankle, and toes; 2 = unable to move hip andknee, able to move ankle and toes; 3 = unable tomove hip, knee and ankle, able to move toes;4 = unable to move hip, knee, ankle, toes).
Hemodynamic parameters were monitored every 5 minutes after the subarachnoid block, both pulse rate and blood pressure were recorded till fixation of block and intraoperatively. Postoperative vitals recorded half hourly till full recovery of spinal effect.

Hypotension a fall in mean blood pressure more than 20% of baseline was treated with intravenous fluids and if it did not improve with fluids, then Inj.Ephedrine 6mg boluses was given intravenous.Bradycardia a fall in heart rate more than 20% of base line during surgery treated with atropine in 0.01 mg/kg dosage.After positioningfor surgery patient were sedated with intravenousInj.midazolam or Inj. Buterophenol in incremental doses which donot act as supplement for inadequate spinal analgesia.

III. Results

Results were recorded and analysed statistically. For comparison of means of two groups student't' was used and comparison of frequencies within group 'X^2'(Chi square)test was used. Data was significant when *p value* was <0.05.Demographically all three groups were comparable related to age,sex,height and ASA grading I and II(Table.1).

There was no significant difference(*p value*->0.05) in onset for sensory block between the groups and within the group on either side(mean 13min SD 4min).Comparison between dependent and nondependent limb statistical significant difference found on dependent(DL) side onset of motor blockade between 1ml(mean13.5min) and 3ml(mean 10.5min) 0.5% bupivacaine(*p value*<0.01) and between 1ml and 2ml(mean11.4min SD 3.6) (*p value*<0.05). While between 2ml and 3ml not significant(*p value*>0.05) as shown in Fig.1 and Fig.2.

There was no statistical difference (*p value*>0.05)on the highest dermatomal level between the group andwithin groups on dependent and nondependent limb on the contrary to observation, this may be due to small sample size in this study.(Table.2) (Fig.3 and Fig.4)

There was significant difference in recovery of sensory as well as motor block among the group and between dependent(D) and nondependent limb(ND) as shown in the Fig.5 and Fig.6.

Reducing dose of spinal drug there is possibility of nondependent limb having no motor block as well as sensory block. In thisstudy 9 patients were without sensory and 15 patients without motor in 1ml group. While 2 cases without sensory and 4 without motor block 2ml . While in dependent limb only 1 patient in 1ml group had no motor action where motor paralysis was not required for surgery. One patient had failed spinal which was excluded from study. Quality of sensory block were adequate for surgical procedures on surgical side (Table.3)

Within fixation time and positioning, out of 75 cases only 5 patient had heart rate reduction more than 20% of baseline which was not related to dose of drug and only one patient needed treatment for bradycardia .While 5 patients each in 2ml and 3ml had fall in mean blood pressure more than 20% of baseline which was significant compared to 1ml group and was treated with intravenous fluids and Inj.Ephedrine 6 mg boluses(Table.4)

Motor block was also adequate for surgery on dependent side in all.Sometimes there will be no sensory as well as motor block on nondependent side with low dose of drug and with 1ml of spinal drug there might be absence of motor block on the dependent side also. Around 1/3 cases in 1ml group nondependent side sensory block was not there, so there is high possibility of unilateral block with low dose of drug for spinal anesthesia.Quality of sensory block was adequate for surgery.(Table.3)

Majority of patients had reduction in heart rate less than 10-20 beats /min more with high baseline heart rate which was not significant and only one patient in 2ml required IV Inj. Atropine .In comparison 2ml and 3ml groups had similar but greater fall in heart rate than 1ml group. So in 1ml SAB there is less change in heart rate as it does not block thoracic sympathetic nerves.

In 20% cases in each 2ml and 3ml had blood pressure fall more than 20% of baseline while none more than 30% in 1ml , which can be explained by high level of block in 2ml/3ml related to high dose of drug in this groups(Table.4).This blood pressure fall in 2ml /3ml may be is contributed to spinal block by relief of pain in addition to sympathectomy. Fall in blood pressure was treated by rapid intravenous infusion of crystalloids and if required with Inj. Ephedrine 6mg intravenously in incremental doses. None of the drop in blood pressure lasted more than few minutes after spinal block.

IV. Tables And Figure

	1ml	2ml	3ml
Sex(M/F)	20/5	19/6	20/5
Age(yrs.) (median range)	40-50	35-45	35-45
Height(cms.)			
<150	01	02	00
151-170	19	17	18
>171	05	06	07

Table 1: Demographic data with comparable distribution

	Dependent side	Nondependent side
1ml	T8	T10
2ml	T4	T4
3ml	T4	T4

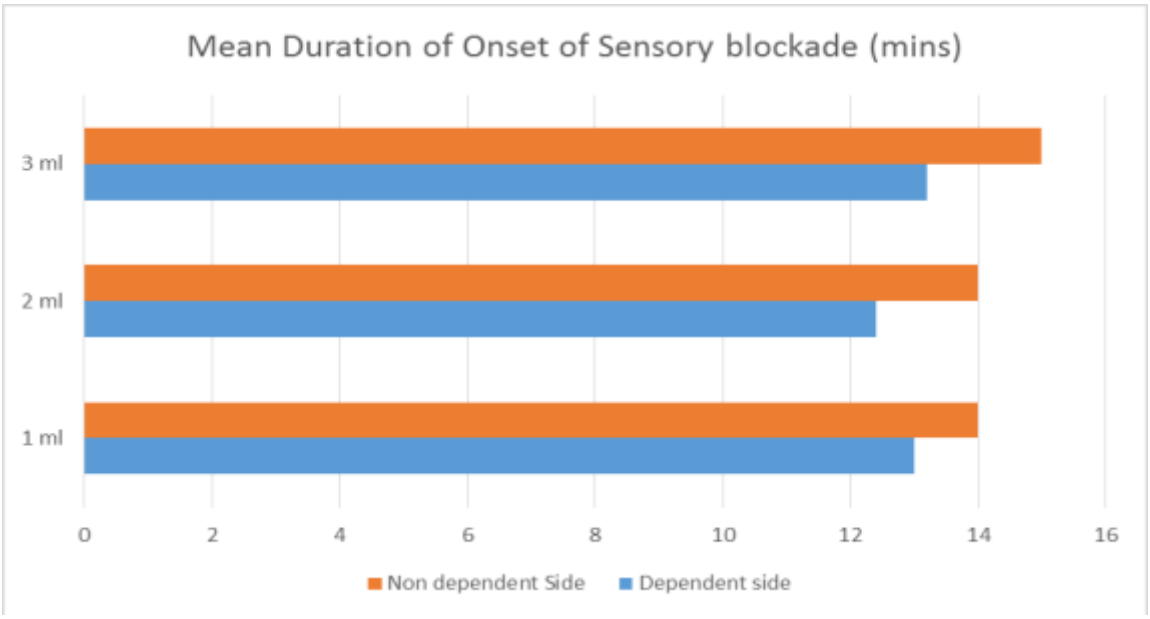
Table 2: Highest dermatomal segment of sensory block

	1ml	2ml	3ml
GOOD	24(96%)	24(96%)	25(100%)
POOR	01(4%)	01(4%)	00(0%)

Table 3: Quality of sensory block in dependent limb

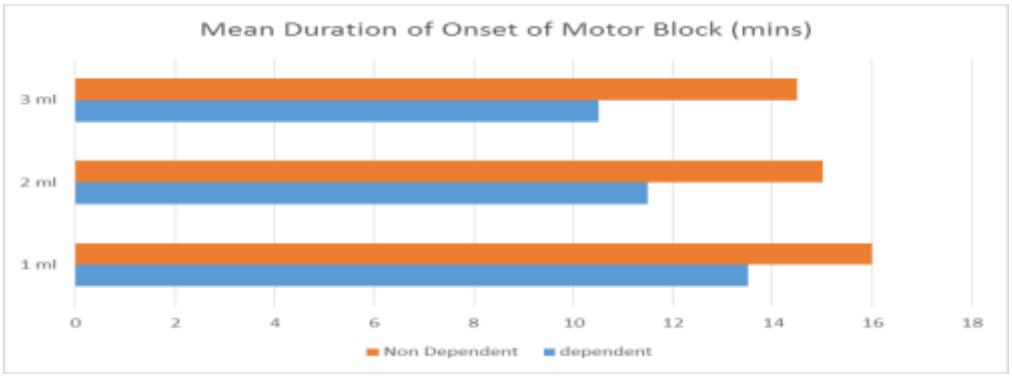
Fall in mean BP(mm of Hg)	1ml	2ml	3ml
<20	25 (100%)	20 (80%)	20 (80%)
>20	00 (0%)	05 (20%)	05 (20%)

Table 4: Change in blood pressure during first 30 mins.



(*p Value>0.05*)

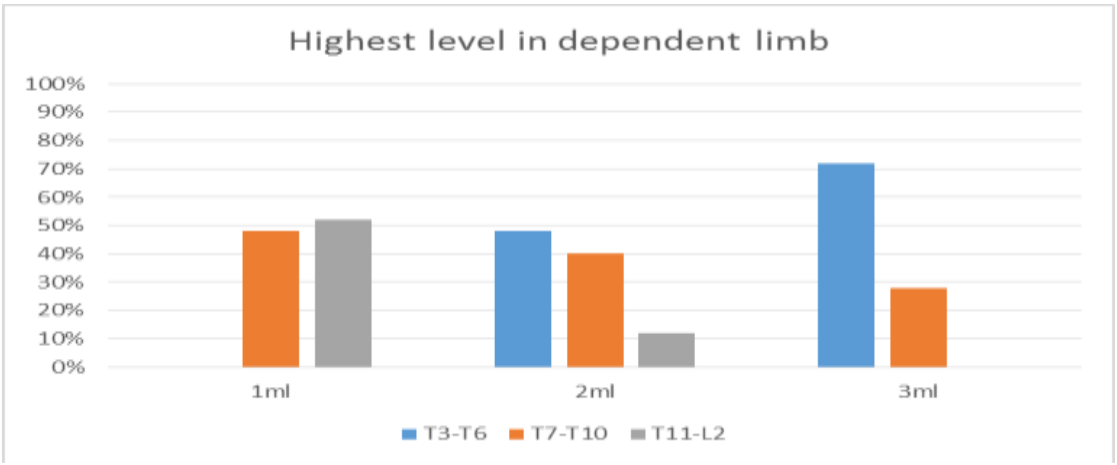
Fig.1: Comparing dependent and nondependent limb for onset of sensoryblock with spinal 0.5% Bupivacaine



(

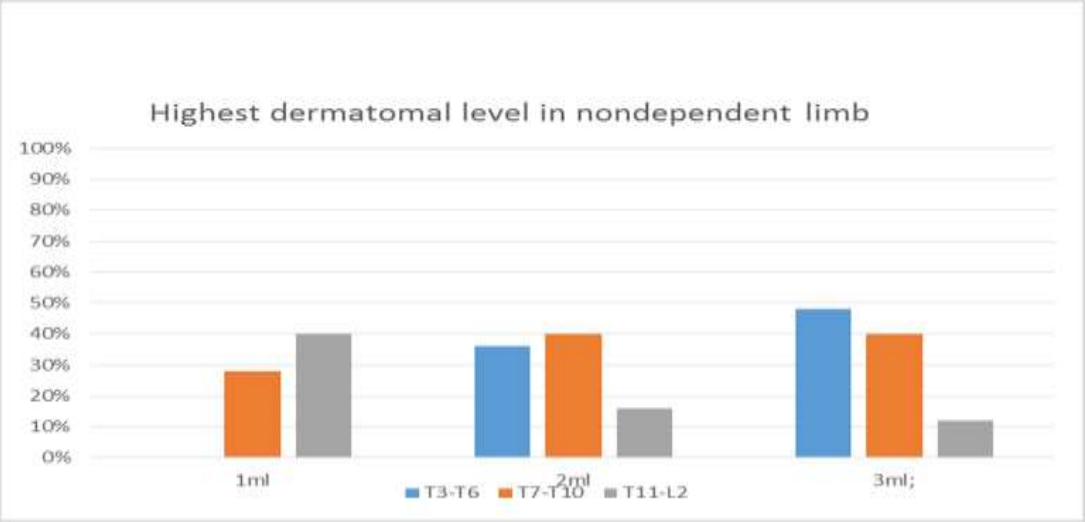
p value <0.05)

Fig.2: Comparing dependent and nondependent limb for onset of motor block with spinal 0.5% Bupivacaine



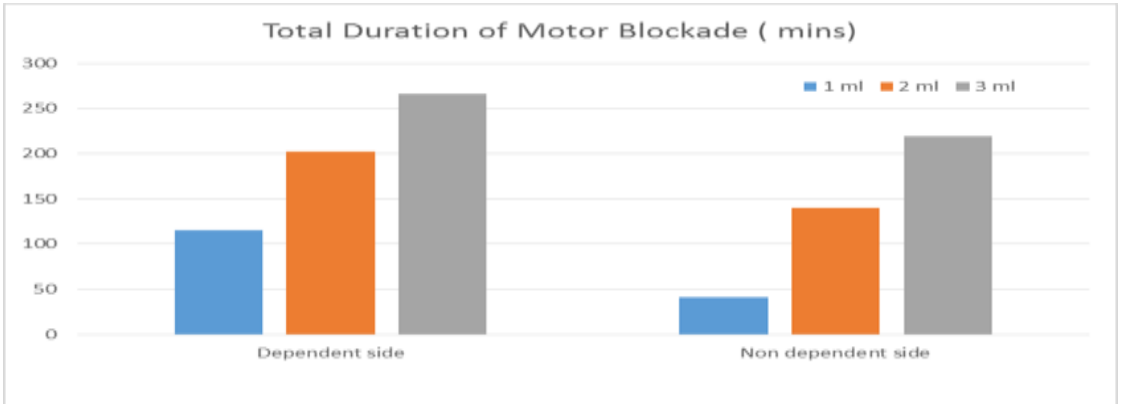
(*p value >0.05*)

Fig.3 Frequency ofdermatomal block with different dosesof spinal drugs–dependent limb



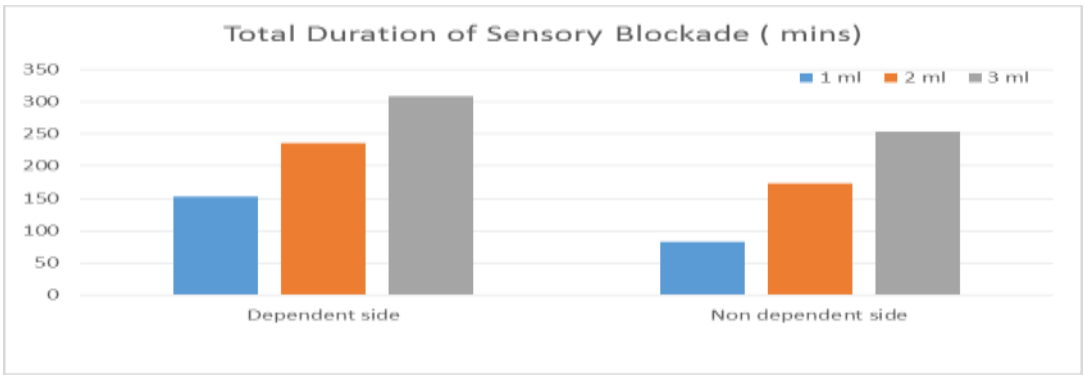
(*p value >0.05*)

Fig.4: Frequency of dermatomal block with different doses of spinal drug--non dependent limb



(*p value< 0.01*)

Fig.5: Mean recovery time of motor block with different doses of Bupivacaine 0.5%comparing dependent limb with non dependent limb



(*p value <0.01*)

Fig.6: Mean recovery time of different doses of 0.5% Bupivacaine comparing dependent limbwithnon dependentlimb

V. Discussion

In this study patient distribution was comparable for age,sex,height and ASA status. All patients were in lateral decubitious position with dependent side being operated and table surface in neutral position as there

strong correlation of lateral position with duration of spinal block[7].Different studies in the past gives conflicting results regarding effect of position and posture of patient during spinal anesthesia on its effect[8,9,10,11,12,13].

In the literature,there are some case reports of unilateral subarachnoid anesthesia. Armstrong (14) reported a unilateral blockinvolving the dependent side after subarachnoid anesthesiawith hyperbaric bupivacaine for cesarean section.Jenkins (15) also reported a unilateral block onthe dependent side in a 37-yr-old male who had a vasectomy. Brimacombe (16), on the contrary, reportedthe case of a unilateral subarachnoid anesthesiawith hyperbaric bupivacaine where the nondependentside, instead of the dependent side, was blocked.These events are difficult to understand, and the authorsgenerally attribute the unilaterality to anatomicabnormalities (such as scoliosis or torsion of the spineresulting in a lateral puncture leading to the formationof a spinal pouch), or by the presence of septae leadingto incomplete or slow block, or even to unilaterality (17). But this study wanted to

Generally local anesthetics should not be used in concentrations higher than is clinically indicated , as the risk for local tissue toxicity might increase with increasing concentrations [18,19]. Therefore, Bupivacaine 0.5% is used in this study, as this concentration has been used for other types of blockades without any reports of toxicity and the addition of 80 mg glucose per ml as this is the commonly used glucose concentration in spinal anesthetic solutions.

Effect of baricity on subarachnoid block with Bupivacaine by Chambers W. A. et al, used 3 ml of 0.5 % Bupivacaine with 8 % ,5 % and 0 % dextrose.They found hyperbaric solutions spread further than plain solution, speed of onset of analgesia was same for all solutions. Onset of motor blockade was quicker with hyperbaric solution[20].

Spinal was given by same person with same speed of 0.2cc/sec in same space with same size of spinal needle in same direction without aspirating CSF to avoid dilution and volume change. Response were checked every five min till spinal fixation of spinal drug shown by non-progress in sensory or motor effect for 5mins. Hemodynamics were checked every 5mins during spinal fixation for comparing and vitals were monitored every 5 mins till surgery was over. Quality of sensory and motor block also checked and recorded in operating limb.

Onset of time for block was measured as the time taken from injection of drug into subarachnoid space to the time when maximum level of surgical analgesia achieved which was non progressive for 5mins. In this study there was no significant difference in onset of action to fixation of block with change in volume of drug on either side of limb. There was significant difference in speed ofblock with different volume as observed by Sundnls K. O.et al[7]. From the data it is seen that all volumes had almost equal latency period for analgesia .This could be explained by low volume of drug taking more time to ascend in subarachnoid space in 1ml and higher level of block in 3ml with high volume of drug.

For different groups majority of patients to complete sensory block and motor block took 6 to 20 mins .But % of motor block in 5mins goes up from 4% in 1ml to 36% in 3ml on dependent side so with increase in dose of drug there is rapid motor blockade as studies by M. C. Sheskey, Anelsson K. H. andChembers W.A.[21,22,23,24], more on dependent side than nondependent side.

In this study there was no statistical significant difference in height of sensory block in all groups and in the same group between dependent and nondependent limb on the contrary to findings of Anelsson K.H.et al[22].This may be due to inadequate sample size in our study. Still highestlevel of sensory block was higher than what observed by Meyer et al in low dose spinal[25].Mean sensory recovery took place in150mins, 240mins,300mins on dependent and 80mins,170mins, 250mins in nondependent side in 1ml,2ml and 3ml respectively.All groups had adequate sensory block on dependent side for the surgical time. While non dependent side sensory block was not there in 9(36%) cases in 1ml,2(8%) in 2ml and nil in 3ml.Study of unilateral spinal by1Meyer et alshowed little higher frequency of unilateral block with low dose spinal with heavy 0.5 bupivacaine may be due to very slow injection of drug at 1ml/min while our was 0.2ml/sec[25].

Reduction of dose of spinal drug and using additive like fentanyl with it, lower limb and hip surgeries can be done without much of complications of spinal anesthesia[26,27]

VI. Conclusion

Volume of drug does not affect onset of spinal block on either limb but it can speed up motor block with increased dose of spinal drug[6].There may be significant difference in level of block on dependent limb than nondependent limb when spinal given in lateral decubitious position and kept in same position till fixation of spinal, which was not the our study may be due to small sample size[16].In all groups dependent side sensory block outlasted than nondependent side. Duration of sensory or motor block increases with increase in dose of the 0.5% bupivacaine. There is significant difference in duration of sensory and motor block in all groups on dependent thannondependent side.

So 1ml of 0.5% bupivacaine can be used for spinal anesthesia if surgery is going to last for less than 2hrs like SSGs, wound debridements, I and D,secondary or primary suturing,K wire removal etc. where general

anesthesia can be avoided. But with 1ml sometimes upper thigh procedure is not possible due to poor sensory block especially in young patients as lowest level of block in this group is L2.

But in elderly patients where spinal effect lasts longer than young patients using additives like fentanyl or clonidine with low dose spinal drug even hip surgeries can be done[18,19]More than 2ml of drug dose is required if there is need of motor block for surgery on lower limb with good sensory block..

More than 2ml of 0.5% dose causes significant drop in BP needing prompt treatment which correlates well with other studies showing high incidence of severe degree of hypotension with higher doses of drug showing correlation between height of sympathetic block which is 2 to 3 segments higher than the sensory block[20].

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