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Continuous epidural analgesia versus continuous femoral nerve block in management of post-operative pain in patients undergoing unilateral total knee arthroplasty: An open labelled randomized controlled trial

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Abstract

Introduction: The most common concern associated with TKR is post-operative pain for both the patient and the surgeon. It is associated with multiple adverse physical and psychological consequences, which hinder postoperative mobilisation, increase the incidence of post-operative complications and the overall outcome.A number of modalities have been recommended of which regional techniques are preferred. Current study aims to compare post-operative management of pain in patients undergoing Total Knee arthroplasty (TKA) with epidural analgesia versus femoral nerve block.

Material and methods: Study was done in 100 patients posted for unilateral TKA. After obtaining written consent and ethical committee clearance patients were randomized in to two groups. Group "CEA"-8 mL 0.2% ropivacaine was given epidurally and Group "CFB"-bolus of 20 mL of 0.2% ropivacaine was given through femoral catheter.

Outcomes assessed were

1) Acute postoperative pain (during rest and movement).
2) Postoperative rescue analgesic consumption/rescue analgesia.
3) Quality of early postoperative rehabilitation (functional assessments).
4) Postoperative complications if any.

Results: There was no significant difference in Vas score during rest and activity in both the groups at 6 hrs,12, 24, 48 and 72 hours. There was no significant difference in both the groups with respect to rehabilitation indices and adverse events. Only 43.4% of patients belonging to group CFB, received rescue analgesia which was less when compared to patients in group CEA(57.6%) which was significant.

Conclusion: CFA have the advantage over CEA in terms of decreased need for rescue. analgesia with no neuraxial side effects.

Keywords: Continuous epidural analgesia, continuous femoral nerve block, post-operative pain, total knee arthroplasty

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Introduction

Total Knee Replacement (TKR) helps relieve pain and restore motion in patients with severe knee Arthritis. Total TKRs being reported to registry increased from 1019 in 2006 to 27,000 in 2019. Majority of the patients (98.5%) were diagnosed with osteoarthritis knee [1]. TKR surgeries are now being increasingly performed in the younger age groups. The most common concern associated with TKR is post-operative pain for both the patient and the surgeon.

Post-operative pain is associated with multiple adverse physical and psychological consequences, which hinder postoperative mobilisation, increase the incidence of post-operative complications and potentially influence the overall outcome [2]. A number of modalities have been recommended for management of post-operative pain, including Administration of pre-emptive analgesics, continuous epidural infiltration, patient-controlled analgesia, peripheral nerve block: femoral nerve block, continuous intra-articular infusion and local intra-articular analgesic injection [3].

Multimodal analgesia combining two or more of the above-mentioned modalities are recommended and found to be beneficial [4]. Of all these modalities, regional techniques are preferred over the others [5,6].

Continuous Epidural analgesia (CEA) has the advantage of providing good analgesia and thus enabling early mobilisation and rehabilitation after TKA. Recently, femoral block is gaining popularity with the increasing use of ultrasound. Femoral Nerve Block (CFB) is found to be enough to provide adequate analgesia after knee surgeries and can be used as a good alternative to epidural block [7]. CFB is less likely to have complications seen with central neuraxial techniques and can be used as an alternative where epidural is contraindicated.

The current study aims to compare post-operative management of pain in patients with epidural analgesia versus femoral nerve block.

Materials and Methods

A comparative study was conducted in a tertiary care teaching hospital, India after obtaining approval from Institutional Ethics Committee. Study was done in patients admitted in orthopaedic department for Total knee arthroplasty during February 2018 to December 2020.

Inclusion: Patients between the age range of 20-65 years, a diagnosis of knee osteoarthritis according to the criteria of the American College of Rheumatology [8]; an American Society of Anesthesiology (ASA) physical status of I-II [9]; no intra-articular treatment with any drug during the past 3 months; no history of prior knee surgery and of BMI less than 30 were included in the study.

Exclusion criteria: Patients with bleeding disorders, infection at the site of block, history of chronic analgesic usage, allergy to local anaesthetics, duration of surgery more than 150 minutes. Simultaneous or staged bilateral TKA or revision surgery, a known history of allergic reaction to any of the test agents, severe chronic medical diseases or chronic disabling diseases were excluded from the study.

For sample size calculation, the study by Shanthanna H *et al.*, with average standard deviation 0.53 was considered to get a power of 80% and a confidence interval of 95% using the formula [7]:

$$n= (Z\alpha + Z\beta)^2 SD^2 \times 2/d^2$$

Where, $Z\alpha$=1.96, $Z\beta$=0.84, SD=standard deviation, d=effect size 0.31. From this the samplesize (n) needed was found to be 45 in each group.

With non-response rate of 10% sample size was 50 in each group.

Hundred patients who were posted for unilateral TKA were selected by purposive sampling method. Patients were randomised and assigned to either of two groups.

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Group "CEA": 8 mL 0.2% ropivacaine was given epidurally.
Group "CFB": Bolus of 20 mL of 0.2% ropivacaine was given through femoral catheter.

Method of study

After obtaining written informed consent, Pre-anaesthetic check-up and routine investigations were done.

Preoperatively

- Nil per oral status was confirmed.
- The procedure was explained and the patient was informed to communicate about perception of any pain or discomfort during the surgery which can be recorded using visual analogue scale.
- Patients were premedicated with tab diazepam 10 mg and tab ranitidine 150 mg orally.

Procedure
Intra venous (IV) access was obtained using 18 gauge (G) IV cannula and Lactated Ringer's solution 500 ml was infused intravenously. In the operating room, monitoring procedures were started to record baseline ECG, PR, BP, RRand SpO_2 till the end of the surgery.
All patients were operated under general anaesthesia without any additional regional anaesthesia technique. TKA was performed through the traditional anterior medial parapatellar approach using a Scorpio non-restrictive geometry posterior- stabilised system (Stryker Howmedica Osteonics, NJ, USA) fixed with cement without patellar replacement. Duration of surgery and the total intraoperative blood loss, including the blood in the suction bottle (after deducting the lavage fluid)and the weights of gauze and sponges were recorded. A drain was clamped in place for the first 6 h postoperatively and removed on post-operative day (POD) 2. For patients in group CEA, 18 G epidural catheter was inserted at L2-3 interspace using 18 G Tuohy needle by loss of resistance technique to air. A test dose of 3 mL of 2% lignocaine with 1 in 2 lac adrenaline was given to rule out intravenous or intrathecal catheter placement. After the completion of surgery and before the analgesia of spinal wore off completely, patients in group CFB were given femoral block on the operated limb through an 18G catheter inserted under ultrasound guidance using in-plane approach and secured by tunnelling into subcutaneous tissue.
After surgery, CEA and CFB was commenced. Sensory block was assessed and confirmed using pinprick and cold sensation and continuous infusion of 0.2% ropivacaine at a rate of 5 mL per hour was given in both groups till 72 hours. Pain was assessed by horizontal visual analogue score (HVAS) at 6,12,24,48and 72 hours postoperatively and also on post-operative day 7 and 14 (POD) [10].When HVAS > 4tramadol 50mg IV was given.
Rescue analgesics requirement during was assessed. Epidural or femoral catheters were periodically checked to rule out migration or infection at the site of insertion and were removed 72 hours post-surgery. Postoperative knee rehabilitation indices were measured by percentage of patients who were able to sit at the bedside and stand with help on the first POD1. On POD2 percentage of patients who were able to stand without help, use the walker, and transfer to chair with help was analysed. Percentage of patients who were able to transfer to a chair and do

walker mobilisation without help was looked for on POD3. Side-effects such as hypotension, dizziness, nausea, vomiting, urinary retention, respiratory depression were recorded.
Data analysis: Data collected in a structured questionnaire, entered and analysed using SPSS 22. Chi-square statistic and t test was used with $P<0.05$ as statistically significant.

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Results

The mean age of the patients was 54.1 years. Majority of the patients were females (60%).Out of 100 patients 26% belong to ASA score I and 74% belong to ASA score II. Varus (79%) was the most common type of deformity in the patients. Out of 100 patients 69% of patients were either overweight or obese. Co-morbidities were present in 69% of patients (like hypertension, diabetes, thyroid and COPD). The patients in both the groups were similar with respect to age, gender, ASA classification, Type of deformity, BMI, Comorbidities, duration of surgery and estimated blood loss (table 1).

Table 1: Distribution of patients in Group CEA versus Group CFB

Parameters		Group CEA(n=50)	Group CFB (n=50)	Total (n=100)	P value
Age (mean ± SD)		53.2± 6.7	55±8.9	54.1± 9.3	T test-1.1425/p-value0.2560
gender	Male	19	21	40	X^2-0.1667/p-value0.68
	Female	31	29	60	
ASA Classification	Score I	12	14	26	X^2-0.2079/p-value0.64818
	Score II	38	36	74	
Deformity	Varus	39	40	79	X^2-2,4308/p-value 0.296585
	Valgus	4	7	11	
	No deformity	7	3	10	
BMI	Normal	13	18	31	X^2-1.1688/p-0.27
	Overweight and obese	37	32	69	
Comorbidities	Present	33	36	69	X^2-0.4208/p-value 0.516
	Absent	17	14	31	
Duration of surgery (in minutes)		90 ± 17	97± 12	93.5 ± 18	T test-1.3593/p-value0.1772
Estimated blood loss (in ml)		345.2 ± 56.1	352 ± 66.1	349.1± 67.8	T test-0.5546/p-value0.5804

Table 2: Visual analogue scale score for pain at rest in Group CEA versus Group CFB

Baseline post-operative Time	Group CEA (mean ± SD)	Group CFB (mean ± SD)	T test/p-value
6 hours	4.92± 1.02	5.2±0.6	1.6731/0.0975
12 hours	4.01±1.08	4.10± 1.12	0.4090/0.6834
24 hours	3.98± 1.25	3.85± 1.23	0.5242/0.6013
48 hours	1.56±0.72	1.62±0.3	0.5439/0.5877
72 hours	1.43±0.2	1.51±0.32	1.4991/0.1371
POD 7	1.23± 0.4	1.02±0.2	3.3204/0.0013
POD 14	1.3±0.1	1.01±0.1	14.500/0.0001

The mean Visual analogue scale score for pain at rest was high initially and decreased with time. There was no significant difference in Vas score in both the groups at 6,12,24,48and 72 hours. In POD 7 and POD 14 VAS score was slightly low in Group CFB which was significant.

Table 3: Visual analogue scale score for pain during activity in Group CEA versus Group CFB

At Time in hours	Group CEA (mean ± SD)	Group CFB (mean ± SD)	T test/p-value
6 hours	8.2 ± 0.9	8.2±0.7	0.00/0.1
12 hours	7.6±1.08	7.3 ± 0.8	1.5783/0.1177
24 hours	6.2± 1.2	6.1± 1.21	0.4149/0.6791
48 hours	5.21±0.76	5.11±0.4	0.4123/0.8233
72 hours	3.42±0.6	3.11±0.3	0.0015/3.2677
POD 7	2±0.3	1.9±0.2	1.9612/0.0527
POD 14	1.7±0.31	1.5±0.12	4.2544/0.0001

The mean visual analogue scale score for pain during activity was high initially and decreased with time. There was no significant difference in Vas score during activity in both the groups at 6 hrs,12, 24, 48 and 72 hours. On POD 7 and POD 14 VAS score was slightly low in Group CFB which was significant. (table 3)

Table 4: Rehabilitation indices of Group CEA versus Group CFB

Rehabilitation indices		Group CEA (n=50)	Group CFB (n=50)	Total (n=100)	X^2/P value
POD 1 sit at bed side and stand with help	Able to perform	27 (48.2%)	29 (51.8%)	56 (56%)	0.1623/0.687013
	Unable to perform	23(52.3%)	21(47.7%)	44(44%)	
POD 2 stand without help, use walker and transfer to chair with help	Able to perform	29(48.3%)	31 (51.7%)	60(60%)	0.1667/0.683091
	Unable to perform	21(52.5%)	19 (47.5%)	40(40%)	
POD 3 transfer to a chair and use walker without help	Able to perform	34 (51.5%)	32 (48.5%)	66 (66%)	0.1783/0.672879
	Unable to perform	16(47%)	18(53%)	34(34%)	

Rehabilitation indices were assessed on POD 1, POD2 and POD 3. They were assessed by checking whether the patients were able to perform activities like sit at bed side and stand with help, able to use walker and transfer to chair. There was no significant difference in both the groups with respect to rehabilitation indices. (table 4)

Table 5: Adverse events of patients in Group CEA versus CFB

Side effects	Group CEA (n=50)	Group CFB (n=50)
Nausea/Vomiting	2 (4%)	6(12%)
Pruritis	0(0%)	0(0%)
Respiratory depression	1(2%)	0(0%)
Urinary retention	2 (4%)	0(0%)
Hypotension/ Dizziness	3(6%)	0(0%)
Deep vein Thrombosis	2(4%)	1(2%)
Incision complications	4(8%)	3 (6%)

Out of 50 patients 14 (28%) patients in Group CEA had side effects where as on 10 patients (20%) in group CFB has side effects. (table 5)

Table 6: Rescue analgesia and Adverse events of patients in Group CEA versus CFB

Parameters	In POD 1,2,3	Group CEA (n=50)	Group CFB (n=50)	Total (n=100)	X^2/P value
Rescue analgesia received	Received	38(57.6%)	28(43.4%)	66(66%)	4.4563/0.034772
	Not received	12(35.3%)	22(64.7%)	34(34%)	
Adverse events	Reported	14(58.3%)	10(41.7%)	24(24%)	0.8772/0.348972
	Not reported	36(47.4%)	40(52.6%)	76(76%)	

Only 43.4% of patients belonging to group CFB, received rescue analgesia which was less when compared to patients in group CEA(57.6%) which was significant. Adverse events were more reported in patients belonging to CEA (58.3%) when compared to patients in Group CFB (41.7%) which was not significant. (table 6)

Discussion

Severe postoperative pain has been associated with serious complications including ischemic cardiac events and myocardiac insufficiency that result from increased stress on the cardiovascular system [11]. In addition, immobilization caused by pain may increase the risk

of decreased pulmonary function, gastrointestinal complications, such as ileus, and thrombus formation that are related to surgical stress[12].

Hence analgesic technique and the immediate and remote postoperative outcome and success of surgery are always interrelated. Epidural group had significantly elevated incidence of urinary retention, dysesthesiaand arterial hypotension [13]. Singelyn*et al*. showed 4 times less incidence of secondary effects with a femoral catheter compared to an epidural one [14] and Chelly *et al*. showed more cardiovascular stability and less nausea and vomiting with Peripheral nerve blocks[15]. The current study compared continuous epidural analgesia over continuous femoral nerve block in post-operative pain management.

The patients in both groups are comparable in the current study with respect to age, gender, BMI, ASA physical status score, type of deformity, co-morbidities and duration of surgery which was similar to study by T G Anupama *etal*. where patients in both the groups were similar with respect to age, gender, ASA physical status score, duration of surgery and weight. Mean age of patients in current study was slightly higher than patients mean age in study by T G Anupama *etal*. [16]

In the current study there was no significant difference between two groups with respect to VAS score during rest and activity till 72 hours which was similar to study by T G Anupama *etal*.,NRS scores for 6, 12, 24, 48 and 72 hours were mostly in the mild or moderate range and were similar in both epidural and CFNB groups[16]. On POD 7 and POD 14 VAS score at rest and during activity was slightly low in Group CFB which was significant in the current study.

In the current study Only 43.4% of patients belonging to group CFB, received rescue analgesia which was less when compared to patients in group CEA(57.6%) which was statistically significant. The finding was similar to study by Ganapathy as well as Capdevilla where a modified 3-in-1 Winnie continuous femoral block with local anesthetic, compared to continuous epidural showed a lower quantity of opioid required to control pain at rest and during passive mobilization [17,13].

In the current study There was no significant difference in both the groups with respect to rehabilitation indices. Ganapathy as well as Capdevilla reported a better articular mobility in the immediate postoperative period in CFB group compared to CEA group [17,13].

Our study is similar to Fowler's meta-analysis which included systematic review of all randomized trials comparing epidural analgesia with peripheral PNB for TKA. In which 464 patients were evaluated for morphine consumption, epidural and PNB side effects, and the patient satisfaction in both the groups[18]. The study reported thatno significant difference in pain VAS scores between epidural and PNB for the first 24 hours; better patient satisfaction in CFB group also suggestedthe addition of sciatic nerve block improves the quality of analgesia by reducing posterior knee and calf pain, corresponding to the area innervated by the sciatic nerve [21-25].

Though adverse events reported in CEA in the current group was slightly higher it was not significant, similar to study by T G Anupama *et al.* and Gandhi H J *et al.* [26].

Conclusions

CFB is as effective as CEA in post-operative pain management in patients undergoing total knee arthroplasty with no significant difference in rehabilitation indices in either of the groups. CFB have the advantage over CEA in terms of decreased need for rescue analgesia with no neuraxial side effects.

References

1. Vaidya SV, Jogani AD, Pachore JA, Armstrong R, Vaidya CS. India Joining the World of Hip and Knee Registries: Present Status-A Leap Forward. Indian J Orthop. 2020 Sep;55(1):46-55.
2. King L, Randle R, Dare W, Bernaitis N. Comparison of oral vs. combined

topical/intravenous/oral tranexamic acid in the prevention of blood loss in total knee arthroplasty: A randomised clinical trial. Orthop. Traumatol. Surg. Res. 2019;105:1073-7.
3. SocietyKorean.Guidelines for the Management of Postoperative Pain after Total Knee Arthroplasty. Knee Surg. Relat. Res.2012;24:201-207. 10.5792/ksrr.2012.24.4.201.
4. Kandarian BS, Elkassabany NM, Tamboli M, Mariano ER. Updates on multimodal analgesia and regional anesthesia for total knee arthroplasty patients. Best Practice & Research Clinical Anaesthesiology. 2019;33(1):111-23.
5. Otten C, Dunn KS. The efficacy of regional anesthesia techniques to control postoperative pain after total knee arthroplasty. Orthopaedic Nursing. 2018;37(3):177-82.
6. Beaussier M, Sciard D, Sautet A. New modalities of pain treatment after outpatient orthopaedic surgery. Orthopaedics & Traumatology: Surgery & Research.2016;102(1):S121-24.
7. Shanthanna H, Huilgol M, Manivackam VK, Maniar A. Comparative study of ultrasound-guided continuous femoral nerve blockade with continuous epidural analgesia for pain relief following total knee replacement. Indian J Anaesth. 2012;56:270-75.
8. Jones IA, Togashi R, Wilson ML, Heckmann N, Vangsness Jr CT. Intra-articular treatment options for knee osteoarthritis. Nat Rev Rheumatol. 2019;15:77-90.
9. De Cassai A, Boscolo A, Tonetti T, Ban I, Ori C. Assignment of ASA-physical status relates to anesthesiologists' experience: a survey-based national-study.Korean J Anesthesiol. 2019 Feb;72(1):53-59.
10. Delgado DA, Lambert BS, Boutris N, McCulloch PC, Robbins AB, Moreno MR,*et al*. Validation of Digital Visual Analog Scale Pain Scoring with a Traditional Paper-based Visual Analog Scale in Adults. J Am Acad. Orthop. Surg. Glob Res Rev. 2018 Mar;2(3):e0-88. Available from https://pubmed.ncbi.nlm.nih.gov/30211382/. Last Accessed on 4-11-2021
11. Mangano DT, Wong MG, London MJ, Tubau JF, Rapp JA. Perioperative myocardial ischemia in patients undergoing noncardiac surgery-II: Incidence and severity during the 1st week after surgery. The Study of Perioperative Ischemia (SPI) Research Group. J Am Coll Cardiol. 1991;17:851-7.
12. Wisner DH. A stepwise logistic regression analysis of factors affecting morbidity and mortality after thoracic trauma: effect of epidural analgesia. J Trauma. 1990;30:799-804.
13. Wattwil M. Postoperative pain relief and gastrointestinal motility. Acta Chir Scand. Suppl. 1989;550:140-5.
14. CapdevilaX,BartheletY,BibouletP,RyckwaertY,RubenovitchJ, d'AthisF. Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery,Anesthesiology. 1999;91(1):8-15.
15. SingelynFJ,DeyaertM,JorisD,PendevilleE,GouverneurJM. Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesiaand continuous three-in-one block on postoperative pain and knee rehabilitation after unilateral total knee arthroplasty,Anesthesia & Analgesia. 1998;87(1):88-92.
16. ChellyJE,GregerJ,GebhardR,*et al*.,Continuous femoral blocks improve recovery and outcome of patients undergoing total knee arthroplasty,Journal of Arthroplasty. 2001;16(4):436-445.
17. AnupamaTG, BinduMV, RavindranRashmi.Continuous Epidural Analgesia and Continuous Femoral Nerve Block for Postoperative Pain after Unilateral Total Knee Arthroplasty: A Prospective Cohort Study. Journal of Clinical and Diagnostic Research. 15, 2021. 10.7860/JCDR/2021/47592.14421.
18. GanapathyS,WassermanRA,WatsonJT*et al*.,Modified continuous femoral three-in-one block for postoperative pain after total knee arthroplasty,Anesthesia and Analgesia. 1999;89(5):1197-1202.
19. FowlerSJ,SymonsJ,SabatoS,MylesPS. Epidural analgesia compared with peripheral nerve blockade after major knee surgery: a systematic review and meta-analysis of randomized trials,British Journal of Anaesthesia. 2008;100(2):154-164.
20. DaviesAF,SegarEP,MurdochJ,WrightDE,WilsonIH. Epidural infusion or combined

femoral and sciatic nerve blocks as perioperative analgesia for knee arthroplasty,The British Journal of Anaesthesia. 2004;93(3):368-374.

21. LongWT,WardSR,DorrLD,RayaJ,BoutaryM,SirianniLE. Postoperative pain management following total knee arthroplasty: a randomized comparison of continuous epidural versus femoral nerve infusion,The Journal of Knee Surgery. 2006;19(2):137-143.
22. WeberA,FournierR,Van GesselE,GamulinZ. Sciatic nerve block and the improvement of femoral nerve block analgesia after total knee replacement,European Journal of Anaesthesiology. 2002;19(11):834-836.
23. MorinAM,KratzCD,Eberhart LHJ, *et al*.,Postoperative analgesia and functional recovery after total-knee replacement: comparison of a continuous posterior lumbar plexus (psoas compartment) block, a continuous femoral nerve blockand the Anesthesiology Research and Practice 7 combination of a continuous femoral and sciatic nerve block,Regional Anesthesia and Pain Medicine. 2005;30(5):434-445.
24. Ben-DavidB,SchmalenbergerK,ChellyJE. Analgesia after total knee arthroplasty: is continuous sciatic blockade needed in addition to continuous, femoral blockade?Anesthesia & Analgesia. 2004;98(3):747-749.
25. CookP,StevensJ,GaudronC. Comparing the effects of femoral nerve block versus femoral and sciatic nerve block on pain and opiate consumption after total knee arthroplasty,Journal of Arthroplasty. 2003;18(5):583-586.
26. DangCP,GautheronE,GuilleyJ, *et al*., The value of adding sciatic block to continuous femoral block for analgesia after total knee replacement,Regional Anesthesia and Pain Medicine. 2005;30(2):128-133.
27. Gandhi HJ, Trivedi LH, Tripathi DC, Dash DM, Khare AM, Gupta MU. A randomized, controlled trial of comparison of a continuous femoral nerve block (CFNB) and continuous epidural infusion (CEI) using 0.2% ropivacaine for postoperative analgesia and knee rehabilitation after total knee arthroplasty (TKA). Journal of Anaesthesiology, Clinical Pharmacology. 2019;35(3):386.
28. Dr. AarushiKataria, Dr. Naveen Nandal and Dr. Ritika Malik, Shahnaz Husain -A Successful Indian Woman Entrepreneur, International Journal of Disaster Recovery and Business ContinuityVol.11, No. 2, (2020), pp. 88–93
29. Kumar, S. (2020). *Relevance of Buddhist Philosophy in Modern Management Theory*. *Psychology and Education*, Vol. 58, no.2, pp. 2104–2111.
30. Aarushi, Naveen Nandal, Parul Agrawal. AN EXPLORATORY RESEARCH IN PRODUCT INNOVATION IN AUTOMOBILE SECTOR. JCR. 2020; 7(2): 522-529. doi:10.31838/jcr.07.02.98