Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

Surgical Outcome of Thoracolumbar Fractures Treated with Short Segment Posterior Screw Fixation

Md. Yousuf Ali[1]*, Chowdhury Iqbal Mahmud[2], Shahida Akter[3], Md. Ashraful Islam[4], Tariqul Matin[5], Shaikh Sadiul Islam[6], M Zawad[7]

[1]Associate Professor, Spinal Surgery, Dept. of Orthopaedics, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Email: bssyousuf@yahoo.com
Orcid ID: 0000-0003-3756-9754
[2]Associate Professor, Orthopaedic Surgery, Dept. of Orthopaedics, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Email: cimahmud@gmail.com
Orcid ID: 0000-0002-5479-1763
[3]Medical Officer, Dept. of Conservative Dentistry, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Email: shahida032003@gmail.com
Orcid ID: 0000-0002-6167-1575
[4]Associate Professor, Orthopaedic Surgery, Dept. of Orthopaedics, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.
Email: dr_ashraf007@yahoo.com
Orcid ID: 0000-0002-2129-6571
[5]Consultant, Orthopaedic Surgery, Dept. of Orthopaedics, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Email: aponnad430@gmail.com
Orcid ID: 0000-0002-0302-6084
[6]Resident, Orthopaedic Surgery, Dept. of Orthopaedics, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Email: Shaikhsadi64dmc@gmail.com
Orcid ID: 0000-0001-5046-3394
[7]Resident, Orthopaedic Surgery, Dept. of Orthopaedics, Bangubandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Email: zawad100@gmail.com
Orcid ID: 0000-0001-5967-0576
*Corresponding author

Received: 09 June 2021
Revised: 15 August 2021
Accepted: 25 August 2021
Published: 22 October 2021

Abstract

Background: The success of surgical treatment of thoracolumbar fractures is directly dependents upon the choice of operative techniques. Now a day, a good number of surgeons using short segment posterior pedicle screw fixation technic in such cases. But we have very few research-based data regarding the effectiveness of this operative technic in treating thoracolumbar fractures. Aim of the study: The present study aimed to assess the effectiveness of short segment posterior screw fixation technic in treating thoracolumbar fractures. **Methods:** This prospective, experimental observational study was conducted on 217 patients with thoracolumbar fractures during the period from July 2006 to June 2020. The centers were Bangabandhu Sheikh Mujib Medical University (BSMMU) and different private hospital of Dhaka, Bangladesh. Only those patients treated with posterior decompression stabilization by posterior short segment fixation and posterolateral fusion were included as the study people. All data regarding the mentioned methods were processed, analyzed and disseminated by using MS word and SPSS version 26 as per need. **Result:** In analyzing the Frankel scores of the participants in different stages of treatment we observed, in pre-operative stage, majority of the patients had 'A' to 'C' scores. At the immediate post-operative stage majority of the patients had Frankel score of 'C' or 'D'. But at the end of one year follow-up, majority of the patients (n=198) achieved 'E' score which was found in 91%. The mean preoperative angle of injured vertebra was 19.7°, the mean postoperative angle was 8.6°, the mean angle at 6 month's follow-up was 11.9°, the mean initial correction was 11.1°, and the mean loss of correction was 3.3°. So, the mean overall correction was found 7.8°. In analyzing the average percentages of the anterior body compression, we observed, in preoperative stage it was 48.1%, and was improved to 29.9% postoperatively, but slightly declined to 32.7% at the latest follow-up. **Conclusion:** Posterior decompression stabilization by posterior short segment fixation with pedicle screw and posterolateral fusion technic may be considered as an effective treatment method in treating thoracolumbar fractures. The chances of kyphotic angle failure are high.

Keywords:- Posterior decompression, Stabilization, Posterior short segment fixation, Posterolateral fusion. Thoracolumbar fractures.

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

INTRODUCTION

Now a day, a good number of surgeons using posterior decompression, stabilization by posterior short segment fixation with pedicle screw and posterolateral fusion technic in thoracolumbar fractures. But we have very few research-based data regarding the effectiveness of this operative technic in treating such cases. Vertebral column fractures are reported to occur in about 6% of trauma patients, with half of them involving the spinal cord or the nerve root.[1] About half of the burst fractures involve thoracolumbar region owing to the presence of biomechanically weak junction especially between T11 and L2 vertebra.[2] The ideal treatment modality to be used in burst fractures of thoracolumbar region still remains controversial with no established consensus for the same.[3] In such cases surgical procedures can comprise of either an anterior or posterior approach. Anterior corpectomy and fixation have shown good results, however, increased morbidity and steep learning curve are the main constraints for its routine use.[4] On the other hand, posterior approach is technically easy to perform and is less extensive. Now a day, various modifications have been made in terms of instrumentation as well as technique. Pedicle screws can minimize the range of movements at spinal segments which can further reduce the damage to soft tissues and increase the rate of synostosis giving a three-column fixation.[5] The fixation can either be short or a long-segment. Short-Segment instrumentation involves one level cephalad and one level caudal pedicle screw fixation and the long-segmental instrumentation involves more than three levels. Literature has shown variable results with the use of short-segment fusion with some studies favoring it,[6] while others have shown high failure rate.[7] But, 'long- segment instrumentation has shown to have a good clinical and functional outcome in few studies'.[7] While several studies recommend posterior fixation augmented with fusion.[8] According to recent reports, short-segment fixation is generally indicated for young and active patients in whom an extensive segment of arthrodesis would result in detrimental effect on motion and for patients in whom good compliance with postoperative spinal bracing is expected.[9] Long-segment fixation is indicated for patients with complete cord injury, elderly patients with pre-existing degenerative disease who are not likely to get benefit from sparing inter-vertebral motion, and patients with poor compliance to wear postoperative spinal brace.[10] Although there have been several reports dealing with short-segment fixation only, they are lack of long-term follow-up to validate the safety as well as efficacy of this instrumentation. Several recent reports also have mentioned the failures in short-segment fixation.[11] The present study aimed to assess the effectiveness of short segment posterior screw fixation technic in treating thoracolumbar fractures.

Objective

General Objective:

- To assess the effectiveness of short segment posterior pedicle screw fixation technic in treating thoracolumbar fractures.

Specific Objective:

- To determine the mode of injury and vertebrae involvement among participants.
- To assess the Frankel scores of the participants in several stages of treatment.
- To evaluate the changes of kyphotic angles of injured vertebra of patients in different stages.

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

- To assess the average percentages of the anterior body compression among patients in different stages.

MATERIAL AND METHODS

This prospective, experimental observational study was conducted on 217 patients with thoracolumbar fractures during the period from July 2006 to June 2020. The centers were Bangabandhu Sheikh Mujib Medical University (BSMMU) and different private hospital of Dhaka, Bangladesh. Only those patients treated with posterior decompression stabilization by posterior short segment fixation and posterolateral fusion were included as the study people. Per-operative events: All patients underwent posterior short segment fixation and decompression and posterolateral fusion. A mechanical distractor was applied to perform indirect ligamentotaxis in an attempt to reduce the retropulsed fragments, and transpedicular decompression was done in cases where more than 50% of the cross-sectional area of the spine was involved. A second-generation cephalosporin was initially used for 5 days postoperatively as prophylactic antibiotic. A thoracolumbar orthosis was prescribed to all of the patients post-operatively and they were encouraged to use for approximately 3 months. Frankel grade was applied to assess the neurologic recovery in the follow-up.[12] Anterior body heights of the injured vertebra and the non-injured, adjacent vertebrae above and below the injured level were measured, and the percentage of anterior body compression (%ABC) was calculated using the formula by Mumford et al.[13]

RESULTS

In this study, the mean (±SD) age of the participants was 35.76 ± 5.06 years. Among total 217 participants, 121 (55.76%) were male and the rest 96 (44.24%) were female. So, male participants were dominating in number and the male-female ratio was 1.26:1. In this study, in majority of the cases, RTA (Road traffic accident) was associated as the mode of injury which was in 74%. In the rest 26% cases, 'fall from height' was the mode of injury. On the other hand, L1 and L2 vertebra was the most common vertebra to get fractured and the ratio was 33% and 39% respectively. In analyzing the Frankel scores of the participants in different stages of treatment we observed, in pre-operative stage, majority of the patients had 'A' to 'C' scores. At the immediate post-operative stage, majority of the patients had score 'C' or 'D'. But at the end of one year follow-up, majority of the patients (n=198) achieved 'E' score which was found in 91%. In this study, the mean preoperative angle of injured vertebra was 19.7°, the mean postoperative angle was 8.6°, the mean angle at 6 month's follow-up was 11.9°, the mean initial correction was 11.1°, the mean loss of correction was 3.3°. So, the mean overall correction was found 7.8°. In this current study, in analyzing the average percentages of the anterior body compression we observed, in preoperative stage it was 48.1%, and was improved to 29.9% postoperatively, but slightly declined to 32.7% at the latest follow-up.

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

Table 1: Mode of injury and vertebrae involvement among participants (N=217)

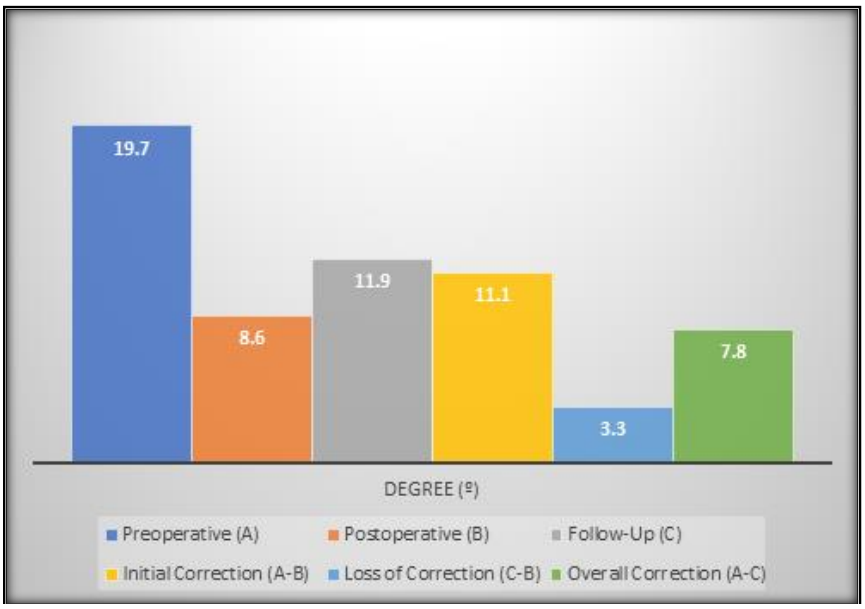
Variables	n	%
Mode of injury		
RTA	161	74.19
Fall from height	56	25.81
Vertebra involved		
T11	17	7.83
T12	30	13.82
L1	85	39.17
L2	71	32.72
L3	14	6.45

Table 2: Frankel score distribution in several stages of treatment (N=217)

Score	Pre-op.	Post-op.	At 1 year
A	46	29	13
B	2	1	1
C	73	25	2
D	27	64	3
E	69	98	198

Table 3: Distribution of the complication of the study

Complication	n=11	%
Severe wound infection	6	54.54
Hardware failure	4	36.36
Dural tear	1	9.09



Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

Figure 1: Mean changes of kyphotic angles of injured vertebra in different stages (N=217)

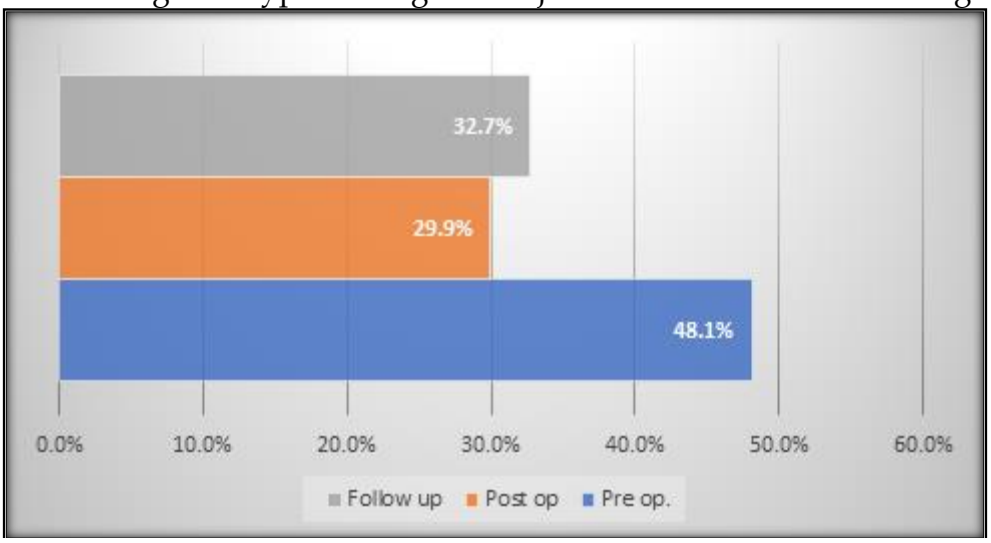


Figure 2: Average percentages of the anterior body compression in different stages (N=217)

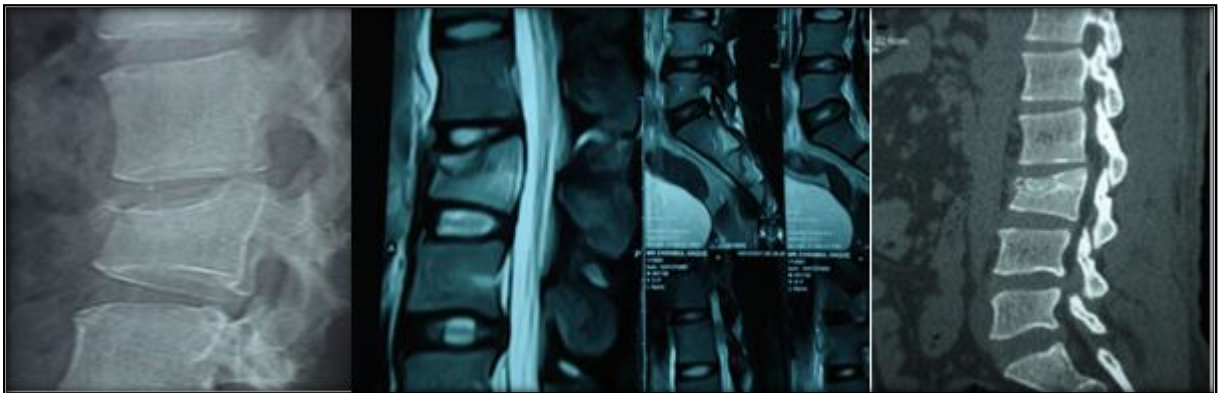


Image 1: Pre-operative X-ray, MRI and CT

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

Image 2: Postoperative image (Immediate)

Image 3: Image of follow-up (After 5 year)

DISCUSSION

The present study aimed to assess the effectiveness of posterior decompression, stabilization by posterior short segment with pedicle screw and posterolateral fusion technic in treating thoracolumbar fractures. In this study, the mean (±SD) age of the participants was 35.76 ± 5.06 years. Among total 217 participants, 121 (55.76%) were male and the rest 96 (44.24%) were female. So, male participants were dominating in number and the male-female ratio was 1.26:1. Loss of initial correction of kyphosis after pedicle screw fixation is reported by many authors in several studies. Lindsey and Dick reported that despite of good surgical correction of kyphosis, most is lost at long-term follow-up.[14] Carl et al reported that 7.4° of correction was achieved then declined by 6.4° at the follow-up, leaving overall correction of only 1.0°.[15] Meanwhile, Razak et al reported 13° of correction and only 2° of correction loss at the follow- up.[16] In our study, the mean preoperative angle of injured vertebra was 19.7°, the mean postoperative angle was 8.6°, the mean angle at 6 month's follow-up was 11.9°, the mean initial correction was 11.1°, the mean loss of correction was 3.3°. So, the mean overall correction was found 7.8°. The most commonly involved vertebra in our study were L1 and L2. The findings of the present study were similar to others in literature.[17] There was a male predominance seen in the present study affecting 56% cases which were consistent with other studies.[18] We had no experience with long term segmental instrumentation in this study. In a retrospective analysis by Hwang JU et al., comparing the results of short-segment fixation and fusion versus only fusion.[6] They concluded that,

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 352-359 | Section- Research Article (Cardiology)

"Fusion has better outcome in terms of kyphosis, pain and implant-related complications". Proponents of the non-fusion believe that it avoids the donor site morbidity, reduces the intraoperative surgical duration and blood loss while preserving the mobility of the adjacent segments.[2] In our study, in analyzing the Frankel scores of the participants in different stages of treatment we observed, in pre-operative stage, majority of the patients had 'A' to 'C' scores. At the immediate post-operative stage, majority of the patients had score 'C' or 'D'. But at the end of one year follow-up, majority of the patients (n=198) achieved 'E' score which was found in 91%. In this current study, the average preoperative % ABC was 48.1%, and that was improved to 29.9% postoperatively, but slightly declined to 32.7% at the latest follow-up. These observations have been confirmed by Quian BP et al., Hwang JU et al., Yang X.[18,19] A recent meta-analysis by Tian NF et al., showed no upper hand of fusion with fixation over fixation alone in unstable thoracolumbar burst fracture fixations. Similar findings were observed in the present study.[20]

CONCLUSIONS

Posterior decompression, stabilization by posterior short segment with pedicle screw and posterolateral fusion technic may be considered as an effective treatment method in treating thoracolumbar fractures. The chances of kyphotic angle failure are high.

Recommendation

This study can serve as a pilot to a much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

REFERENCES

1. Burney RE, Maio RF, Maynard F, Karunas R. Incidence, characteristics, and outcome of spinal cord injury at trauma centers in North America. Arch Surg. 1993;128(5):596-9. doi: 10.1001/archsurg.1993.01420170132021.
2. Verheyden AP, Spiegl UJ, Ekkerlein H, et al. Treatment of Fractures of the Thoracolumbar Spine: Recommendations of the Spine Section of the German Society for Orthopaedics and Trauma (DGOU). Global Spine J. 2018;8(2 Suppl):34S-45S. doi:10.1177/2192568218771668
3. Singh R, Rohilla RK, Kamboj K, Magu NK, Kaur K. Outcome of pedicle screw fixation and monosegmental fusion in patients with fresh thoracolumbar fractures. Asian Spine J. 2014;8(3):298-308. doi: 10.4184/asj.2014.8.3.298.
4. Tezeren G, Bulut O, Tukenmez M, Ozturk H, Oztemur Z, Ozturk A. Long segment instrumentation of thoracolumbar burst fracture: fusion versus nonfusion. J Back Musculoskelet Rehabil. 2009;22(2):107-12. doi: 10.3233/BMR-2009-0224.
5. Sanderson PL, Fraser RD, Hall DJ, Cain CM, Osti OL, Potter GR. Short segment fixation of thoracolumbar burst fractures without fusion. Eur Spine J. 1999;8(6):495-500. doi: 10.1007/s005860050212.
6. Hwang JU, Hur JW, Lee JW, Kwon KY, Lee HK. Comparison of posterior fixation alone and supplementation with posterolateral fusion in thoracolumbar burst fractures. J Korean Neurosurg Soc. 2012;52(4):346-52. doi: 10.3340/jkns.2012.52.4.346.
7. Kothe R, Panjabi MM, Liu W. Multidirectional instability of the thoracic spine due to iatrogenic pedicle injuries during transpedicular fixation. A biomechanical investigation. Spine (Phila Pa 1976).

1997;22(16):1836-42. doi: 10.1097/00007632-199708150-00008.
8. Yang H, Shi JH, Ebraheim M, et al. Outcome of thoracolumbar burst fractures treated with indirect reduction and fixation without fusion. Eur Spine J. 2011;20(3):380-386. doi:10.1007/s00586-010-1542-3
9. McCormack T, Karaikovic E, Gaines RW. The load sharing classification of spine fractures. Spine (Phila Pa 1976). 1994;19(15):1741-4. doi: 10.1097/00007632-199408000-00014.
10. McLain RF, Sparling E, Benson DR. Early failure of short-segment pedicle instrumentation for thoracolumbar fractures. A preliminary report. J Bone Joint Surg Am. 1993;75(2):162-7. doi: 10.2106/00004623-199302000-00002.
11. Kramer DL, Rodgers WB, Mansfield FL. Transpedicular instrumentation and short-segment fusion of thoracolumbar fractures: a prospective study using a single instrumentation system. J Orthop Trauma. 1995;9(6):499-506. doi: 10.1097/00005131-199509060-00007.
12. Frankel HL, Hancock DO, Hyslop G, Melzak J, Michaelis LS, Ungar GH, et al. The value of postural reduction in the initial management of closed injuries of the spine with paraplegia and tetraplegia. I. Paraplegia. 1969;7(3):179-92. doi: 10.1038/sc.1969.30.
13. Mumford J, Weinstein JN, Spratt KF, Goel VK. Thoracolumbar burst fractures. The clinical efficacy and outcome of nonoperative management. Spine (Phila Pa 1976). 1993;18(8):955-70.
14. Sasso RC, Cotler HB, Reuben JD. Posterior fixation of thoracic and lumbar spine fractures using DC plates and pedicle screws. Spine (Phila Pa 1976). 1991;16(3 Suppl):S134-9. doi: 10.1097/00007632-199103001-00019.
15. Carl AL, Tromanhauser SG, Roger DJ. Pedicle screw instrumentation for thoracolumbar burst fractures and fracture-dislocations. Spine (Phila Pa 1976). 1992;17(8 Suppl):S317-24. doi: 10.1097/00007632-199208001-00018.
16. Razak M, Mahmud MM, Hyzan MY, Omar A. Short segment posterior instrumentation, reduction and fusion of unstable thoracolumbar burst fractures--a review of 26 cases. Med J Malaysia. 2000;55 (Suppl C):9-13.
17. Benzel EC, Larson SJ. Postoperative stabilization of the posttraumatic thoracic and lumbar spine: a review of concepts and orthotic techniques. J Spinal Disord. 1989;2(1):47-51.
18. Yang X, Huo H, Xiao Y, Xing W, Zhao Y, Fu Y. Pedicle screw fixation and allograft bone in posterior spinal fusion for treatment of thoracolumbar vertebral fractures. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2009 May;23(5):520-3.
19. Qian BP, Qiu Y, Wang B, Yu Y, Zhu ZZ. Effect of posterolateral fusion on thoracolumbar burst fractures. Chin J Traumatol. 2006;9(6):349-55.
20. Tian NF, Wu YS, Zhang XL, Wu XL, Chi YL, Mao FM. Fusion versus nonfusion for surgically treated thoracolumbar burst fractures: a meta-analysis. PLoS One. 2013;8(5):e63995. doi: 10.1371/journal.pone.0063995.

Source of Support: Nil, Conflict of Interest: None declared