Traumatic brain injury related research in India: An overview of published literature

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ABSTRACT

Aim: This paper provides an overview of publications by Indian researchers on traumatic brain injury between 1966 and 2014, to set up a platform for evaluating and synthesizing the results and findings from brain injury research in India.

Materials and Methods: All published articles from India related to brain injury since 1966 to 2014 were retrieved from PubMed using the search for (“craniocerebral trauma”[MeSH Terms] OR (“craniocerebral”[All Fields] AND “trauma”[All Fields]) OR “craniocerebral trauma”[All Fields] OR (“head”[All Fields] AND “injury”[All Fields]) OR “head injury”[All Fields]) AND (“India”[MeSH Terms] OR “India”[All Fields]) A data base for variables like study type/category, year of publication, place of study institutes and departments to which the corresponding author belonged or where the study was conducted and the journal of publication was developed in FileMaker Pro 13 Advanced® software. Frequencies and percentages was obtained using R statistics software.

Results: A total of 624 original research articles from India were reviewed. There was a substantial increase in the number of publications from 2006 (175) to 2014 (213). Eighty percent of studies were primary clinical observational type. Only 1.6% of studies were on animal experiments. Original research articles were about 55.8%. One fourth of the studies are prospective in nature. Researchers from 46 medical departments have been involved in publishing papers on traumatic brain injury. Among these, the neurosurgery department has published highest number of publications (262), followed by the forensic medicine (32) and the neurology (21). Many institutes from 22 states have contributed in brain injury research. Delhi alone had published nearly one-fourth (23%) of papers. Eleven states had published papers in collaboration with other countries. Papers were published both in national and international journals. Neurology India had published 20.6% of papers.

Conclusion: There is rapid increase in publications since last decade with multi departmental integration and international collaborations. However with existing brain injury resources in our country much more research work at both basic and clinical level should be encouraged.

Key Words: Articles, basic, brain injury, clinical, India, departments, epidemiological, institutes, journal, neurosurgery, neurotrauma, PubMed

INTRODUCTION

India comprise of 29 states and 7 union territories. It is second most populous country in the world with...
estimated population of 1.27 billion during 2014-2015.[1] Traumatic Brain Injury (TBI) is a major public health problem in India. The increase in economic growth in India coupled with rise in population, motorization and industrialization has contributed to a significant increase in TBI with each advancing year. TBI results in deaths, injuries and disabilities in all age groups but more in young and productive persons and higher in males than females.[2] National level data in India is not available for TBI as in many other developed countries. An epidemiological study in Bangalore indicates that the incidence, mortality and case fatality rates were 150/1,00,000, 20/1,00,000 and 10%, respectively.[3] The most common cause of TBI normally reported in our country are road traffic accidents (RTA) accounting for 60%, followed by falls and assaults contributing to 25% and 10% of traumatic brain injuries respectively.[3] The economic losses to India due to TBIs are phenomenal, though unmeasured.

However, despite the increase in TBI burden, research as evidenced by publications in scientific journals pertaining to TBI is grossly inadequate in India. There are no studies in India that have evaluated the publishing strength of medical departments and institutes and the number of articles published by researchers from related disciplines and the scientific impact of these articles. The purpose of our study is to understand the scientific contribution of India in published research of TBI.

MATERIALS AND METHODS

The literature search for brain injury from India in PubMed with specific subject headings related to traumatic brain injury (“craniocerebral trauma”[MeSH Terms] OR (“craniocerebral”[All Fields] AND “trauma”[All Fields]) OR “craniocerebral trauma”[All Fields] OR (“head”[All Fields] AND “injury”[All Fields]) OR “head injury”[All Fields]) AND (“India”[MeSH Terms] OR “India”[All Fields]) was used as the search terms for each database. Every effort was made to identify all relevant articles that report data related to traumatic brain injury from India with Indian authors as corresponding author from 1966 to 2014. Two independent reviewers (including corresponding author) have evaluated all reference titles obtained from the database. Any reference title that appeared to involve brain injury and India was selected. The research articles were classified based on recommendation by Röhrig, et al.[4] The research work was classified into primary and secondary research. The primary work was further classified into basic, clinical and epidemiological studies. The basic work was further divided into theoretical and applied; clinical and epidemiological was divided into experimental and observational studies. The secondary work constitutes review and meta-analysis research work. The details of articles selections are shown in flow chart [Figure 1]. The impact factor as per 2013-14 for all the journals that have published articles on TBI was documented from journal publisher website and Cite Factor website.[5] FileMaker Pro 13 Advanced® software was used for database management.

Statistical analysis

The data was analyzed using R Statistics (R.3.2.0). Data was expressed using descriptive statistics - frequency and percentage for categorical variables. The data for each variable were arranged in table(s) in descending order.

RESULTS

During 1966-2014 the search yielded 624 articles [Figure 1]. The trend of publications since 1966 till 2014 is shown in Figure 2. The details about types of articles are shown in Figure 3. The common type of article published was “original article” followed by “case report". The details of study a category is shown in Figure 4. The commonest type of study was primary clinical observational. A study on primary basic applied was 0.95% of all publications. Studies related to rodents were about 1.6% (n-10). In overall publication 24.5% (n-153) was prospective in nature. The departments that contributed to research publication is given in Table 1. The maximum contribution came from neurosurgery department. Maximum contributions came from All India Institute of Medical Sciences (AIIMS), New Delhi, followed by Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh and National Institute of Mental Health and Neurosciences (NIMHANS), Karnataka [Table 2]. Most of the articles were published in Neurology India.

DISCUSSION

The purpose of this study was to determine the region wise publication practice of TBI studies from institutions, departments, and journals that have published head injury research work from India. In PubMed, we found 624 research articles related to TBI from India during the study period. From all over India, institutes from 22 states have contributed in TBI research. Maharashtra state has highest number of institutes (25) that have contributed to research publications in TBI, followed by Tamil Nadu (20), New Delhi (16), Andhra Pradesh (14) and Uttar Pradesh and Karnataka (12). Among number of publications New Delhi leads with 144 papers, followed by Karnataka (73), and Maharashtra (66). Of 22 mentioned states, 11 states have published in association with other countries. Researchers from New Delhi, Maharashtra and Uttar Pradesh have published more papers with international collaboration as compared to other states. Forty six departments published research work related
or association with TBI, of them neurosurgery is leading with 41.9%, followed by forensic medicine (5.1%), neurology (3.3%) etc. Though most of the studies published were original articles (55.8%), they are primary clinical observations (79.5%), generating low level of scientific evidence. Reviews and longitudinal studies are published occasionally. Studies on animal experiments are the lowest (1.6%).

Of the researchers from 29 states and 7 union territories, only those from 20 states and 2 union territories have contributed in brain injury research so far. India has around 362 medical colleges both at government and private setup. Of them only 59 have neurosurgical departments recognized for MCh Neurosurgery training program. The institutes with neurosurgical training are approved for only 190 candidate’s intake per year. There are approximately 1,800 neurosurgeons in India with one neurosurgeon for treating 25-30 lakh general population, which is a very low doctor patient ratio as compared to any developed country (one neurosurgeon per 2.5 lakh). Almost all major cities in India have facilities to treat TBI patients. India has nearly 90 biological science Research Institutes that mainly focus on basic research. Of them only few biological research institutes are involved in brain injury research. Translational research from experiment to humans is still insubstantial.

This manuscript reports that the contribution of India in published research, which adds knowledge and bridges gaps in brain injury area, is grossly sparse. It amounts to as low as one percent of published research articles in PubMed. Indian authors publishing in association with foreign authors provides strength to scientific papers with exchange of newer ideas and multi departmental integration. As per the findings of this paper, the Department of Neurosurgery has been leading in brain injury publications accounting for 41.9% of the total publication on TBI research. This could be primarily due to the fact that in India the department of Neurosurgery manages the initial treatment of brain injury cases first and then later refers to specialized departments. Most of the head injury cases involve medico legal angle due to being road traffic injury cases that are regulated by law. Hence the forensic medicine department is involved in scientific publications to the extent of 5.1% of research papers. There is a dearth of research studies with a prospective design that could lead to better understanding of the aetiology of brain injuries in Indian conditions.

Brain injury research articles from India were published in 192 indexed journals, of which 33 are Indian Journals and 159 journals are international journals with high impact factors. It was observed that there has been an
increasing trend in publication in last 15 years, with about two-third of the retrieved papers having been published during 2001 to 2014. Most of these articles are published in national journals. An increasing trend has also been observed in number of publications in international journals in last fifteen years, however very few articles are published as compared to contribution from any developed countries.

The number of population injured per lakh has increased two fold from 1970 to 2011. RTAs accounts for major share in TBI in India. During 1970 to 2011, there is 7.3 times increase in road accident injuries.\[^{10}\] As a result, a large number of individuals with TBI endure life-long impairment and disability. The sudden occurrence of brain injury places phenomenal burden on day-to-day activities, affecting survival and income. It was estimated that the total costs of road traffic injuries alone is about 55,000 crore a year in India.\[^{11}\] Despite increase in TBI cases, there is lack of commensurate increase in research in TBI at all levels. The possible causes for lack of interest in research are lack of funding, lack of interest among neurosurgeons and others treating TBI, lack of time as there is skewed ratio of neurosurgeons to population. The neurosurgeon takes more pride in demonstrating his surgical skills for removal of a complex skull base or vascular lesions, the incidence of which is very rare, but does not have interest in improving care of victims of TBI, the incidence of which is high.

**Future**

India has emerged as one of the foremost global destinations for clinical research. There is phenomenal increase in number of higher education institutions since 2009.\[^{12}\] India is ranked third in research output after China and Japan in Asia.\[^{13}\] Since 2006, there is rapid increase in publications on brain injury research nationally as well as with international collaborations. With the current pace of publications it is expected that India will occupy a higher position at the global level in coming years. This communication is expected to motivate many neurosurgeons and allied specialists to pursue research in TBI, and share their scientific findings in high impact journals.

**CONCLUSION**

Publication and research in TBI from India is lacking despite significant increase in incidence of TBI. In order to highlight the importance of TBI treatment and management among policy makers, more scientific

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**Table 1: Number of departments that have published brain injury data in India**

| Department                             | Number (n) |
|----------------------------------------|------------|
| Neurosurgery                           | 262        |
| Forensic medicine                      | 32         |
| Neurology                              | 21         |
| General surgery                        | 22         |
| Imaging and radiology                  | 16         |
| ENT and head neck surgery              | 21         |
| Oral and maxillofacial surgery         | 22         |
| Anesthesia                             | 21         |
| Neurological sciences                  | 13         |
| Medicine                               | 7          |
| Community medicine                     | 13         |
| Plastic and reconstructive surgery     | 12         |
| Ophthalmology                          | 9          |
| Clinical psychology                    | 8          |
| Pharmacology                           | 6          |
| Biochemistry                           | 7          |
| Critical care medicine                 | 5          |
| Pathology                              | 5          |
| Orthopedics                            | 5          |
| Pediatric neurology and neurosurgery   | 21         |
| Trauma and emergency                   | 8          |
| Physical medicine and rehabilitation   | 5          |
| Psychiatry                             | 2          |
| Community dentistry                    | 1          |
| Nuclear medicine                       | 1          |
| Biostatistics                          | 1          |
| Microbiology                           | 1          |
| Nephrology                             | 3          |
| Biomedical engineering                 | 2          |
| Dentistry                              | 2          |
| Endocrinology                          | 2          |
| Epidemiology                           | 2          |
| Food science and nutrition             | 1          |
| Nursing education                      | 2          |
| Urology                                | 1          |
| Transportation research and injury division | 1       |
| Pedodontics                            | 2          |
| Zoology                                | 2          |
| Audiology                              | 1          |
| Cardiology                             | 1          |
| Dermatology                            | 1          |
| Hospital administration                | 1          |
| Instem                                 | 1          |
| National automotive sampling system    | 1          |
| Neurobiology laboratory                | 1          |
| Prosthodontics                         | 1          |
| Dul-Hasti hydro-electric project       | 1          |
| Rourkela steel plant project           | 1          |

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**Table 2: Statewise distribution of publications and collaborations related to brain injury research in India**

| States                | Number of publications (n) | International collaboration |
|-----------------------|---------------------------|----------------------------|
| New Delhi             | 144                       | 3                          |
| Karnataka             | 73                        | 1                          |
| Maharashtra           | 66                        | 3                          |
| Tamil Nadu            | 64                        | 1                          |
| Chandigarh            | 52                        | 1                          |
| Uttar Pradesh         | 43                        | 2                          |
| Jammu and Kashmir     | 24                        | 2                          |
| Andhra Pradesh        | 21                        | 2                          |
| Rajasthan             | 15                        | 1                          |
| Kerala                | 10                        |                            |
| Punjab                | 12                        | 1                          |
| West Bengal           | 12                        |                            |
| Haryana               | 11                        | 3                          |
| Madhya Pradesh        | 5                         |                            |
| Pondicherry           | 5                         |                            |
| Jharkhand             | 5                         | 2                          |
| Gujarat               | 4                         |                            |
| Orissa                | 4                         |                            |
| Utharakhand           | 3                         |                            |
| Himachal Pradesh      | 2                         |                            |
| Bihar                 | 2                         |                            |
| Goa                   | 1                         |                            |

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evidence should be generated by the researchers. More funding agencies should come forward for funding TBI research.

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Conflicts of interest
There are no conflicts of interest.

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