Review article

The top 10 arthroplasty articles published in last 10 years by Indian authors

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ABSTRACT

Joint replacement surgery is becoming increasingly popular globally and recently, in India. The phenomenon of medical tourism has also contributed to increasing number of arthroplasty surgeries being done every year in our country. The surgeons who work in this highly specialized field of orthopedic surgery, have been publishing their research work in reputed journals. In this paper, we have discussed the most cited Indian papers in the field of arthroplasty. It was observed that publications in high impact and reputed journals attract more citations and therefore it is recommended that the 'good' scientific research work should preferably be submitted to these journals to create greater impact and awareness about one's research.

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1. Introduction

Citation frequency of a paper indicates the influence it exerts in any area of research. Several articles have been written recently on the most influential papers in the field of science in general,¹ various medical specialties, and orthopedic surgery in particular.^{2–17} Researchers have also attempted to find the most cited papers in the different subspecialties of orthopedic surgery^{18–34}; and also, popular papers related to some specific disorders, like distal radial fractures and anterior cruciate ligament injuries,^{35,36} or from a particular region.^{37–44}

In this bibliometric analysis, we attempted to find the top 10 most cited Indian papers in the field of arthroplasty and joint replacement surgery; using Web of Science and SCOPUS databases, besides PubMed and general Internet search (including Google scholar). The papers presented in this study may serve as a list of Indian articles useful for orthopedic surgery postgraduate residents and fellows in arthroplasty. This list inspires us about how and what kind of research work can be carried out in the area of joint replacement surgery, working within relatively constrained socio-economic, cultural and managerial scenario which is unique to one's country and to achieve excellence with limited resources.

Focused study of these papers may also give some insights on what makes a paper important to global peers, and also help in writing such articles in future.

2. Methods

Citation databases, including Web of Science and SCOPUS, were searched using the following key terms and search strategy: India* AND (arthroplasty OR hip replacement OR knee replacement OR ankle replacement OR shoulder replacement OR elbow replacement OR wrist replacement); in the month of April 2017. The search was further refined to include only papers published in the English language from India in the years 2006 till date. We ranked and arranged the papers according to the number of citations received during this period. The top 10 papers in the field of joint replacement, which were based on research conducted entirely in India, were manually selected and the full texts were retrieved. The final ranking of top 10 papers was done according to the number of citations mentioned in SCOPUS, as this citation database has broader coverage as compared to Web of Science.^{45–49} We have also checked the search strategy and the number of citations received by these papers in Google Scholar, which is a free citation database with very broad coverage; but did not use it for finding influential papers because of inadequate quality control. Several inaccuracies reported in Google Scholar- like content gaps, incorrect citation counts, duplication and manipulation of citation

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numbers' make its reliability questionable.^{48,49} Finally, we have also checked citations in the free full-text database Pubmed Central, but despite consistency, it has little utility as it covers only journals, which provide free full texts for it. The methodology of paper selection adopted by us has been explained comprehensively in Fig. 1.

3. Results

The search was done, as described earlier, in the Web of Science and in SCOPUS databases in the month of April 2017. From the Web of Science, 714 papers and from SCOPUS, 1591 papers were collected. (Fig. 1) There is a growing trend in the number of papers published in the field of arthroplasty from India over the past several years (Fig. 2). We also analyzed the number of papers by different authors and papers coming from various institutions on the SCOPUS citation database. These papers were then arranged according to the quantum of citations received during this period, in both the databases and then we manually selected top 10 articles, which were based on research conducted in India and relevant to the field of arthroplasty (Table 1). We preferred SCOPUS for final ranking as it has relatively broader coverage. Out of these papers, ten most cited, Indian papers were selected, as already explained.

Most papers (8) were from private institutes, though some (2) were from government institutions in this group (Fig. 3A). All of these papers were published in high impact journals in arthroplasty and related fields. One paper each was published in Clinical Orthopaedics and Related Research; International Orthopaedics; Knee Surgery, Sports Traumatology, and Arthroscopy; and Best Practice and Research: Clinical Rheumatology; two in Journal of

Fig. 2. Trend line showing number of arthroscopy papers published from India in the last 10 years as analysed in SCOPUS.

Bone and Joint surgery (British volume, now renamed as the Bone and Joint Journal); and four papers in Journal of Arthroplasty. (Fig. 3B). All of these articles have been widely cited by authors from many different countries and in high impact orthopedic journals, including several citing papers which have themselves received many citations in this short time span; reflecting the world wide influence of these papers on the subject of arthroplasty.

The top ten Indian arthroplasty articles were based on studies at different levels of evidence in the hierarchy, including Randomised controlled trial (level 1- four papers), Therapeutic study (level 2-one paper), Prospective comparative study (level 2-one paper), Observational study or case series (level 4- three papers), Broad narrative review (level 5-one paper). Citations received by these

Fig. 1. Chart showing the methodology of selecting papers.

Table 1

Top 10 most cited papers in arthroplasty from India.

S No	Paper	Authors	Type of study	Citations in SCOPUS (Citation Density)	Citations in Web of Science (Citation Density)	Citations in PMC
1.	Most effective regimen of tranexamic acid in knee arthroplasty: A prospective randomized controlled study in 240 patients knee ⁵⁶	Maniar RN et al	Randomised controlled trial (level 1)	98(24.5)	73(18.25)	24
2.	Clinical Orthopaedics and Related Research. 2012;470(9):2605–2612. Blood loss in total knee arthroplasty: An analysis of risk factors ⁵⁷	Prasad N et al	Observational study (level 4)	87(9.66)	65(7.22)	22
3.	International Orthopaedics. 2007;31(1):39–44. The use of alendronate in the treatment of avascular necrosis of the femoral head: Follow-up to eight years ⁵⁸	Agarwala S et al	Observational study (level 4)	83(11.87)	54(7.71)	21
4.	Bone & Joint Journal. 2009 Aug 1;91(8):1013–8. Comparison of Limb and Component Alignment Using Computer-Assisted Navigation versus Image Intensifier-Guided Conventional Total Knee Arthroplasty. A Prospective, Randomized, Single-Surgeon Study of 467 Knees ⁵⁹	Mullaji A et al	Randomised trial (level 1)	59(6.56)	52(5.78)	12
5.	The Journal of arthroplasty. 2007 Oct 31;22(7):953–9. Efficacy of periarticular injection of bupivacaine, fentanyl, and methylprednisolone in total knee arthroplasty. A prospective, randomized trial ⁶⁰	Mullaji A et al	Randomised trial (level 1)	55(9.16)	41(4.56)	10
6.	The Journal of arthroplasty. 2010 Sep 30;25(6):851–7. Efficacy of intra-articular tranexamic acid in blood loss reduction following primary unilateral total knee arthroplasty ⁶¹	Roy SP et al	Therapeutic study (level 2)	54(13.5)	40(10)	11
7.	Knee Surgery, Sports Traumatology, Arthroscopy. 2012 Dec 1;20(12):2494–501. Osteoarthritis ⁶²	Das SK et al	Broad narrative review(level 5)	52(6.5)	42(5.25)	10
8.	Best Practice & Research Clinical Rheumatology. 2008; 22(4):657–75. Computer-Assisted Total Knee Arthroplasty for Arthritis With Extra-articular Deformity ⁶³	Mullaji A et al	Case series (level 4)	40(5.9)	30(4.29)	10
9.	The Journal of arthroplasty. 2009 Dec 31;24(8):1164–9. A Comparison of Coronal Plane Axial Femoral Relationships in Asian Patients With Varus Osteoarthritic Knees and Healthy Knees ⁶⁴	Mullaji A et al	Prospective comparative study(level 2)	38(5.43)	32(4.57)	11
10.	The Journal of arthroplasty. 2009 Sep 30;24(6):861–7. One- or two-stage bilateral total hip arthroplasty. A prospective, randomised, controlled study in an Asian population ⁶⁵	Bhan S et al	Randomised controlled trial (level 1)	37(3.7)	33(3.3)	7
	Bone & Joint Journal. 2006 Mar 1;88(3):298–303					

papers at different levels of evidence have been demonstrated in Fig. 3C.

4. Discussion

Bibliometrics is the science and art of citation analysis i.e. the study of citation pattern of published data. Citation is a marker of the importance given by the author of a paper to others' work on a particular topic.¹⁶ Citations received by an article are an indicator of influence within a field, of authors, journals, and topics of study.^{1–44} The citation rate of a paper can be calculated by dividing the total number of citations received by the total number of years since publication.^{16,50–54}

Citation counts vary with the database used, raising doubts on such analyses.^{44–48} Some other important problems related to citations include self-citation, preference to cite articles in the target journal, preferential citation of English language articles, and unaccounted (missing) textbook and conference citations.^{15,51,52} Recently published articles are at a disadvantage (citation counts tend to rise with time). Authors are also more likely to cite a previously well-cited article due to its previous citations, rather than for its intrinsic quality (snowball effect).¹⁵ 'Obliteration by incorporation' is said to happen when truly classic papers are cited less as they merge into the body of current knowledge. Sometimes, such truly classic papers now only exist in the bibliography of so-called top-cited papers. 'Incomplete citing' means erroneous citations, made just to convince or persuade the reader, rather than to give credit to original or important workers.

Self-citation, journal bias, in-house bias, omission bias (not citing competitors), powerful person bias, national bias, state or institutional bias, and language bias also confound the overall picture.^{2,16,55,56}

The most cited study in this group⁵⁷ was a prospective randomized controlled trial by Minar et al. to find effective regimen(s) of tranexamic acid in total knee replacement (TKR). 206 consecutive patients with knee osteoarthritis planned for primary, unilateral TKR were prospectively enrolled in the study. Five regimens were studied (4 intravenous, and 1 local; 40 cases each) along with a control group. Intravenous regimens (10-mg/kg dosage) included (A) intraoperative dose (IO) prior to tourniquet deflation, (B) extra preoperative dose (POIO), (C) extra postoperative dose (IOPPO), and (D) all 3 doses i.e., preoperative-intraoperative-postoperative (POIOPPO). The last regimen consisted of local application only. This local application reduced blood loss, as compared to control, but a single intravenous intraoperative (IO) dose could not. The two-dose regimen (POIO) was the least frequency needed for effectiveness – a reduced of drain output and total blood loss. IOPPO regimen was not effective. POIOPPO regimen had the maximum benefit.

The second study⁵⁸ by Prasad et al. analyses the risk factors for blood loss in TKR. Factors (like-sex, etiology, tourniquet time and Quilet index) affecting the peri-operative and hidden blood loss, besides blood component replacement need in primary cemented TKR(single surgeon) were prospectively studied in 66 consecutive patients. Apparent blood loss was calculated by adding blood loss during surgery- calculated by weighing the sponges used during

Fig. 3. A. Pie chart showing distribution of top 10 arthroplasty papers from India according to type of institution (public/private sector), B. Pie chart showing distribution of top 10 arthroplasty papers from India according to journal of publication, and C. Bar graph showing Level of evidence versus average number of citations received on SCOPUS.

surgery and measurement of blood in the suction bottle and post-operative drain output at 48 h. Males had significantly more blood loss. Blood loss between osteoarthritis and rheumatoid arthritis cases was not significantly different; but, need for blood replacement was greater in rheumatoid cases as they had low hemoglobin prior to surgery. Duration of tourniquet application and of surgery, both were positively correlated with peri-operative blood loss, but body mass index did not significantly affect blood loss in this series. Hidden blood loss, estimated by the difference between estimated blood loss (calculated by Gross formula –

based on maximum post-operative decrease in hemoglobin adjusted for the height and weight) and apparent blood loss, was about 38%.

The third study⁵⁹ Aggarwal et al. is case series with clinic-radiological study of 395 hips, analyzing alendronate usage for the treatment femoral head osteonecrosis. All cases had received 10 mg alendronate daily following usual precautions, for 3 years along with 500 mg to 1000 mg of calcium and 400 IU to 800 IU of vitamin D3. On average 4 years follow up, it improved clinical function, reduced collapse rate, and the requirement for total hip

replacement (THR) particularly if the treatment was begun in the pre-collapse stage. Even in Fiat stage-II and III hips, THR was delayed.

The fourth study⁶⁰ by Mullaji et al. is a randomized trial reporting improvement in limb and component alignment on using computer-assisted navigation as compared to preoperative scanogram (to individualize distal femoral valgus cut) and image intensifier (to identify hip and talar dome centers) – guided TKR. But, for knees exceeding 20° varus, there was no significant difference between the mean mechanical axes in the two groups.

The fifth study⁶¹ by Mullaji et al., shows effectiveness of periarticular injection of a cocktail of bupivacaine (a long-acting local anesthetic providing more sensory than motor blockade), fentanyl (an opioid with 100 times more potency than morphine), and methylprednisolone (an intermediate-acting corticosteroid), by comparison of quadriceps function, knee flexion, and pain scores just after surgery, postoperative day one, at discharge, and two and four weeks after surgery in infiltrated and the non infiltrated knees (side randomised) in 40 cases of bilateral simultaneous navigated TKR. The infiltrated knees had superior quadriceps recovery for up to 2 weeks, along with greater active flexion, and lower pain scores for up to 4 weeks after TKR.

The sixth study by Roy et al.⁶² is a randomized trial evaluating intra-articular tranexamic acid for reducing blood loss in primary TKR, with 50 patients each in intervention and control groups. The surgical stress of TKR and intra-operative pneumatic thigh tourniquet increase local fibrinolysis, which significantly contributes to postoperative blood loss. Tranexamic acid inhibits fibrinolysis at the site of active bleeding and clot formation and not in the general systemic circulation. Thus, there is no increased risk of deep vein thrombosis or thromboembolism, despite some theoretical concerns. Effectiveness of locally administered intra-articular tranexamic acid for reduction of blood loss and need for transfusion were demonstrated.

The seventh paper⁶³ by Das and Farooqi is a broad narrative review on osteoarthritis. Major risk factors are age, female gender, obesity (100% amongst elderly with BMI more than 40), geographic factors {endemic osteoarthritis- e.g. Kashin-Beck's disease in China, Hip osteoarthritis (Handigodu disease-HJD) in Shimoga district western Karnataka (India), and Mseleni disease-MJD in Northern Zululand, South Africa; are all related to spondylo-epiphyseal dysplasia, in spite of being present in localized geographical areas}, physical labor, occupational knee-bending, joint trauma, genetic factors, chondrocalcinosis and vitamin D deficiency. Osteoarthritis of hip is uncommon in developing Asian countries, but this is not related to frequency of hip dysplasia, which has same prevalence in east and west. Osteoarthritis causes joint pain (worsening with weight bearing and activity), stiffness (morning stiffness or after inactivity – gelling), and functional limitation of joint. The commonest is knee involvement, followed by that of hand, hip, and cervical and lumbar spine. Treatment needs multidisciplinary case based approach. Different modalities including physical exercises (including but not limited to quadriceps strengthening), yoga, orthotic devices (e.g. valgus knee brace), walking aids, thermal modalities, drugs like paracetamol, NSAID, tramadol, diacerin, colchicine, and nutraceuticals like glucosamine, intraarticular injections-corticosteroids and hyaline, and at last surgical options like arthroplasty and osteotomies have been discussed.

The eighth study⁶⁴ by Mullaji et al. is a series on computer-assisted TKR for arthritis with paraarticular deformity. They studied 22 femoral and 18 tibial deformities in 34 cases. Usually, both soft tissue balance and alignment can be assured in TKR by suitable bony resections within the joint and soft tissue releases, if the deformity is within the joint. However, in cases with significant deformities or deformities outside the joint, one may create

imbalance of collateral ligaments by using only intra-articular bony resections and wide soft tissue releases, and may therefore be forced to use constrained implants. To avoid this, one may do extra-articular osteotomy at the apex of the deformity; when big distal femoral or proximal tibial bony cuts may damage the collateral ligament insertions or lead to difficulties in gap balancing. In this study, for femoral deformities, the planned distal femoral cut was drawn a perpendicular to the mechanical axis of the femur, on standing whole limb x rays (scanogram). An extra articular corrective osteotomy can be properly done using navigation. Tibial osteotomy (relatively easier) was performed in three cases, but femoral osteotomy (more problematic) was not needed in any case. Due to wide distal femoral medulla, intramedullary stems only may not stabilize the osteotomy. Additional plate may be necessary. Alternatively, one may proceed stage wise, doing corrective osteotomy using a plate or intramedullary nail in first stage followed by TKR in the second stage. But, correction of the deformity at intraarticular level needs an extensive release, and thus create a larger flexion gap. Upsizing the femoral component may help in gap balancing—navigation software may help in planning femoral component size, anteroposterior translation and flexion-extension. Early results were satisfactory. Long-term follow-up is needed for further validation.

The ninth study⁶⁵ by Mullaji et al. compares coronal femoral axes in Asian patients with varus knee osteoarthritis with those in normal knees. Femoral axes were measured on scanograms in 250 limbs in cases with varus knee osteoarthritis and 50 normal controls. Mean angle between distal femoral axis and mechanical axis was $7.3^\circ \pm 1.6^\circ$. Mean femoral bow was $3.6^\circ \pm 2.5^\circ$ in patients (significantly higher) compared to $5.5^\circ \pm 0.8^\circ$ and $0.4^\circ \pm 1.2^\circ$ in controls, respectively. Significantly lower femoral condylar-mechanical axis angle was there in osteoarthritic knees ($89.9^\circ \pm 2.8^\circ$) as compared to that in controls ($93.1^\circ \pm 1.6^\circ$). Varus had significant correlation with femoral bowing. Several Asian cases are deficient in vitamin D and calcium resulting in osteomalacia and osteoporosis, which may lead to femoral bowing. If the bowing happens due to varus angulation at the knee associated with medial compartmental collapse or whether slight bowing from a young age and associated medial compartment overload leads to arthritis is a matter of further investigation in the form of longitudinal radiological studies. Limbs with osteoarthritis (18.8%) had more than 9° distal femoral axis- mechanical axis angle. Coronal mechanical axis restoration to within 3° of normal in TKR leads to reduced loosening and longer survival of prosthesis.

The tenth study⁶⁶ is a, randomized, controlled prospective study in Asian patients comparing single-stage bilateral total hip arthroplasty with a double-stage procedure. Out of total 168 cases in the study, 83 had a single-stage and 85 had a double stage procedure. In one stage operation as the skin closure with staples was begun on the first hip, the second assistant unscrubbed and then scrubbed with a separate nurse for the other hip. The time elapsed between last skin staple on the first hip to the skin incision on the second hip was 15 to 20 min. The operating time, intraoperative blood loss, and any intraoperative complications were recorded. In the one-stage group the operating time was calculated as the time between the induction of anesthesia and skin closure on the second hip, and in staged procedures as the sum of the time between the induction of anesthesia and skin closure in each operation. Age, gender, etiology, pre-operative hemoglobin, ASA status, preoperative limb-length discrepancy and the HHS, and complications in the early postoperative period were not significantly different between the two groups. Estimated total blood loss was lower in patients undergoing a one-stage procedure, but the transfusion requirements were significantly higher. Authors conclude that single-stage bilateral THA is as safe as a two-stage procedure in patients in ASA grade 1 and grade 2 and

probably also in grade 3 and 4. Also, the length of hospital stay was reduced in the one-stage procedure leading to lesser costs.

Another paper⁶⁷, by Shah et al., a randomised trial comparing continuous femoral nerve block with adductor canal block post TKR also had a similar number of citations (37 times) in SCOPUS. Femoral nerve block provides nice analgesia, but at the cost of reducing quadriceps strength, and therefore leads to a higher risk of fall. Adductor canal block is nearly purely sensory, and quadriceps muscle strength is minimally affected (some portion of vastus medialis is affected due to seepage of the local anesthetic agent). 100 patients were prospectively randomized into two groups, receiving femoral and continuous adductor canal blocks. Ambulation ability (timed up go, 10-m walk, 30 s chair test), time to active straight leg raise, quad sticks, staircase competency, and ambulation distance were significantly better in adductor canal group whereas pain scores and opioid need were not significantly different.

Some well cited papers written earlier may be mentioned. The paper by Bhan et al.⁶⁸ has been cited 117 times in SCOPUS. Also, the paper⁶⁹ entitled “General principles of osteoarticular tuberculosis” by Tuli SM, which has received 161 citations in SCOPUS, may be a nice reading.

Conflict of interest

None.

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