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Revisão da Literatura

Functional capacity after total hip arthroplasty: anterior, posterior and postero lateral approaches-a systematic review

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Resumo

Objetive: To compare functional outcomes following total hip arthroplasty (THA) performed through anterior, posterior, and posterolateral surgical approaches in patients with hip osteoarthritis. **Data source**: This systematic review was conducted according to PRISMA 2020 guidelines and registered in PROSPERO (CRD42024549538). Searches were performed in PubMed, Scopus, Web of Science, PEDro, and Cochrane Library databases for randomized controlled trials published between 2019 and 2024, including patients older than 45 years undergoing unilateral THA for osteoarthritis. **Data synthesis**: A total of 605 records were identified, and three randomized controlled trials comprising 185 participants met the eligibility criteria. The studies assessed functional capacity, pain, and physical performance outcomes, and methodological quality was evaluated using the PEDro scale. Overall, the included studies reported no statistically significant differences in functional outcomes among anterior, posterior, and posterolateral approaches. The direct anterior approach showed slightly better results in some functional measures in individual studies; however, these differences were not consistent across outcomes or follow-up periods. A higher incidence of lateral femoral cutaneous nerve injury was reported in patients undergoing the direct anterior approach. **Conclusions:** Current evidence suggests that anterior, posterior, and posterolateral approaches yield comparable functional outcomes after THA. Although the direct anterior approach may be associated with minor short-term functional benefits, it may also present a higher risk of lateral femoral cutaneous nerve injury. However, the certainty of evidence is limited due to the small number of studies and participants. Further high-quality randomized controlled trials with larger samples and longer follow-up are required.

Palavras-chave: Osteoarthritis, Hip; Arthroplasty, Replacement, Hip; Clinical Trial.

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INTRODUCTION

Osteoarthritis (OA) is characterized as a degenerative joint disease prevalent in the adult and elderly population, presenting joint stiffness, pain, limitations, progressive deformities and loss of function. The painful condition occurs due to cartilage insufficiency, generated by an imbalance between the formation and destruction of its main elements, associated with a set of conditions such as: mechanical overload, biochemical changes in the cartilage and synovial membrane and genetic factors.[1]

With the advancing age of the population and the increase in obesity worldwide, the impact of OA is expected to become a significant challenge for health systems on a global scale.[2] In this way, advances in treatments become unique. Among these methods, pharmacological, non-pharmacological (physiotherapeutic treatments), alternative therapy methods (homeopathy, acupuncture and herbal medicines) and, finally, surgical treatments stand out.[3]

Total hip arthroplasty (THA) is a surgical treatment that involves replacing the hip joint with a synthetic prosthesis.[4] It is considered a relatively safe intervention, providing significant pain relief and reducing disability, as it allows the replaced joint to function normally.[5]

According to Jones[6], hip arthroplasty is widely recognized as one of the greatest advances in the treatment of orthopedic diseases and is among the most performed surgeries worldwide. Due to its rapid recovery and ability to return to daily activities, it is considered one of the few medical procedures that fully benefit the patient. The surgery is acclaimed as having the best results in orthopedics, as evidenced by a clinical trial involving 228 patients, in which 91% of them reported satisfaction with the result.

There are several surgical approaches, with the common types of approaches being anterior, posterior and lateral approaches. However, there is no consensus in the literature regarding the criteria that orthopedic surgeons should consider when choosing the approach.[7]

The posterior hip approach was popularized by Moore in the 1950s and is widely adopted in contemporary THA practice. As revealed by a survey of surgeons around the world, this technique is the most prevalent surgical approach internationally, being chosen by approximately 36% of arthroplasty surgeons in the Canadian context. This approach provides comprehensive and accurate visualization of the acetabulum and femur during reconstructive procedures, while preserving the integrity of the abductor muscles during surgical exposure.[7]

The classic anterior approach is known to preserve the insertion of tendons and muscles, early restoration of gait kinematics and low rates of dislocation, but can be more challenging in patients with anatomical variations.[3] There is a risk of injury on the lateral femoral cutaneous nerve (LFCN). With the advancement of surgical techniques, adaptations of this approach have emerged, such as the direct

anterior approach, which theoretically presents a lower risk of dislocation of the prosthesis. However, its wider adoption is limited by the need for specific tools, such as angled femoral and acetabular drills, a traction table, and a longer learning period.[8]

There are several surgical approaches for total hip arthroplasty, with the posterior and direct anterior approaches being among the most commonly used. However, there is no consensus in the literature regarding the criteria that orthopedic surgeons should consider when choosing between these approaches, particularly with respect to postoperative functional outcomes.[7]

Despite the success of the surgery, the search for its improvement and better results is constant, especially concerning the long-term prosthesis, combined with the development of new surfaces, biomaterials with greater biocompatibility and less aggressive surgery techniques, aiming for full recovery of patients' quality of life, along with the restoration of functionality. Therefore, this systematic review aims to compare functional capacity in the postoperative period of total hip arthroplasty via direct anterior and posterior access.

MATERIAL AND METHODS

This study was written according to the preferred reporting items for systematic reviews and meta-analysis statement of 2020.[10] The review was registered on PROSPERO, on may 21, 2024, and its registration number is: CRD42024549538.

Research question and eligibility criteria

The research question was developed using the PICO strategy[11], which also helped us establish the inclusion and exclusion criteria for the selection of relevant studies. The research question was: does the posterior approach of total hip arthroplasty promote better functional capacity when compared with the direct anterior approach? Only randomized clinical trials (RCT), published between the years 2019 and 2024, were included.

Patients

Participants included humans (masculine or feminine), over 45 years, that underwent unilateral total hip arthroplasty due to osteoarthritis. Any patient with secondary arthritis, previous hip or knee surgery, neurological disorders and health issues that prevent proper post-operative recovery and rehabilitation were excluded.

Intervention

The chosen intervention consisted of a unilateral direct anterior surgical approach for total hip arthroplasty, performed by orthopedic-surgeons.

Comparison

The comparison group consisted of any unilateral posterior surgical approach for total hip arthroplasty.

Main outcomes

The aimed outcomes consisted of evaluation of physical capacity, pain and activity through any of the following tests: Harris Hip score (HHS)[12], The Western Ontario and McMaster Universities Arthritis Index (WOMAC)[13], Oxford Hip Score (OHS)[14], Hip Disability and Osteoarthritis Score (HOOS)[15], Trendelenburg Test, Time Up and Go (TUG), 2 Minute Walk Test, 6 Minute Walk Test and 10 Minute Walk Test. Postoperative nerve damage was also assessed.

Search strategy

A systematic literature search was conducted in PubMed, Cochrane Library, and Web of Science databases on June 10, 2024. The search strategy was developed using Medical Subject Headings (MeSH) and included the following terms: *"osteoarthritis, hip", "arthroplasty, replacement, hip", and "clinical trial"*. The descriptors within the same category were combined using the Boolean operator "OR", while the main descriptors were combined using "AND". Filters were applied for publication date (2019–2024), English language, and participants aged over 45 years.

Reference management was performed using EndNote software for duplicate removal. Subsequently, all references were exported to the Rayyan web application for screening and study selection.

Study selection was conducted independently and blindly by two reviewers (SILVEIRA, D. A. and XAVIER, L. R. L.). In the first stage, titles and abstracts were screened according to the inclusion and exclusion criteria. In the second stage, full-text articles were assessed for eligibility. Any disagreements between reviewers were resolved by a third reviewer (COSTA, M.A.R.).

Data extraction

For data collection, two reviewers (SILVEIRA, D. A. and XAVIER, L. R. L.) used an excel spreadsheet to obtain and register the following information: author, year and country of the study, type of study, loss of patients, median age, outcomes measured, DAA results, PA and PLA results and *p* values. Therefore, the data were compared, and any discrepancies were resolved by discussion. In case of lack of consensus, the third reviewer was requested to resolve the conflict. In case of incomplete or missing data, the authors of the studies were contacted.

Risk of bias

Methodological quality was assessed using the PEDro scale. The PEDro scale consists of 11 items evaluating internal validity and statistical reporting of randomized controlled trials. Scores range from 0 to 10, with higher scores indicating better methodological quality. Studies scoring ≥6 points were considered to have moderate to high methodological quality. However, achieving this threshold does not eliminate the possibility of bias. Several PEDro domains were not fulfilled across the included studies, particularly those related to blinding and allocation concealment. Therefore, although the studies demonstrate moderate to high methodological quality, the presence of potential sources of bias should be acknowledged and considered when interpreting the results.

Table 1: Excluded articles and reasons for exclusion. 1- Closed study; 2- Inconclusive studies; 3- Patients with other pathologies; 4- Other types of surgical access; 5- Another type of study.

Author, Year	Reason for exclusion
Winther SB, 2019	5
KUMAR GARG,2023	1
JIANG S, 2020	3
CHUN ZHA,2019	2
QIAN, Qirong,2019	4
HONGJIE, Chen,2023	5

RESULTS

Search and study selection

The search resulted in a total of 586 articles identified (Cochrane = 534, PubMed = 50, and Web of Science = 2). After removal of duplicates, 549 records remained for screening. Following title and abstract screening, nine studies were selected for full-text evaluation. Among these, four studies were ongoing and two did not meet the inclusion criteria. Table 2 presents the reasons for exclusion. The final sample consisted of three included studies. Figure 1 illustrates the study selection process.

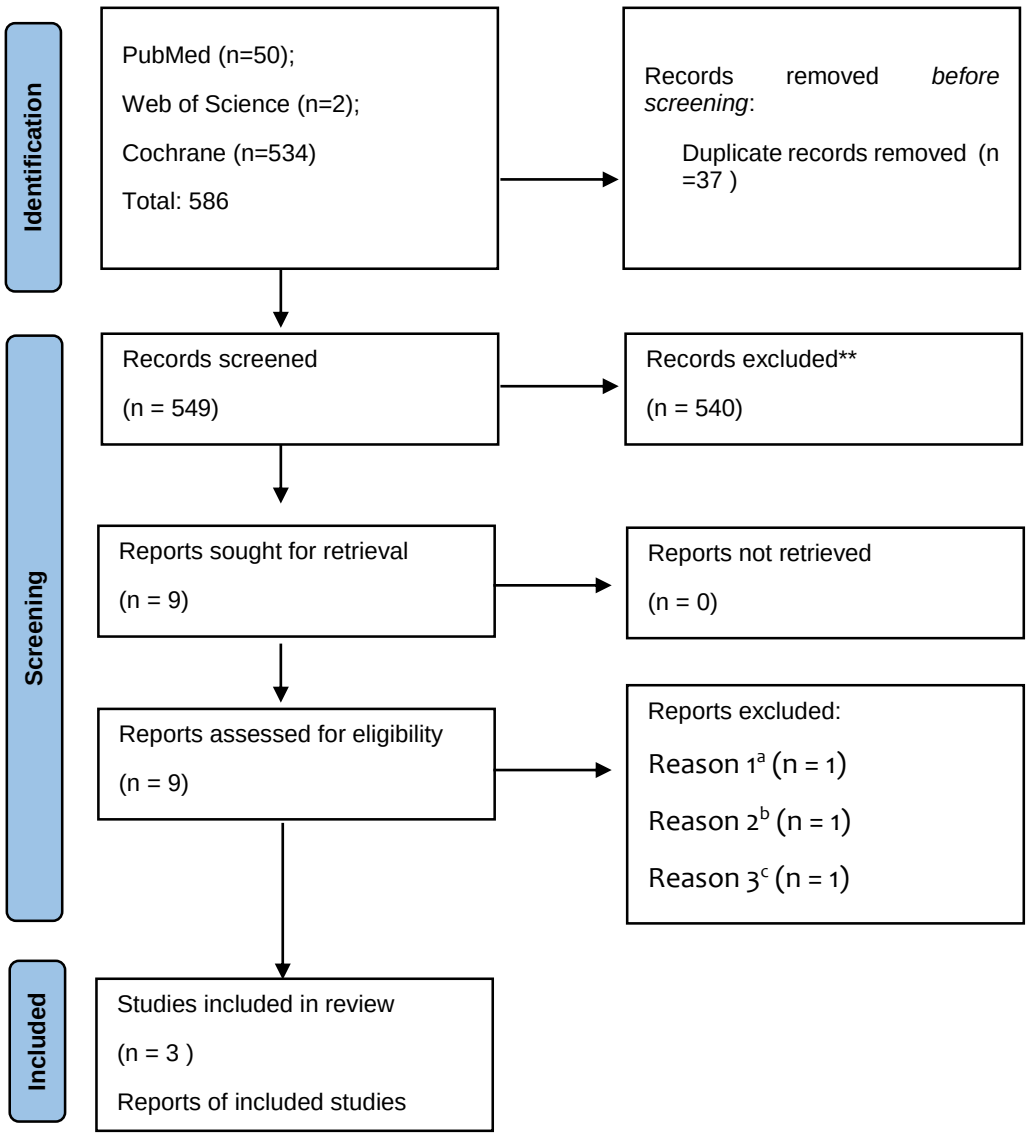
Study characteristics and results

All study characteristics and primary outcomes are presented in Table 1, while a narrative synthesis is provided below.

Two studies[17,18] were randomized controlled trials with five-year follow-up of their original cohorts, comparing the direct anterior approach (DAA) with the posterior approach (PA). One study[19] was a randomized controlled trial with one-year follow-up comparing DAA and posterolateral approach (PLA). The studies were conducted in the United States of America[17], Australia[18], and the Netherlands.[19]

A total of 185 participants were included across the studies. Sample sizes ranged from 46 to 87 participants, with ages ranging from 48 to 78 years. Overall, 94 participants (50.8%) were female and 91 (49.2%) were male. In total, 89 patients underwent DAA, 73 underwent PA, and 23 underwent PLA. Among PA patients, 32 were male and 41 were female, while in the PLA group, 11 were male and 12 were female. In the DAA group, 48 were male and 41 were female. Mean ages were reported as 61.4, 64, and 62 years for DAA[17,18,19]; 63 and 66 years for PA[17,18]; and 63 years for PLA.[19]

Figure 1. Identification of studies via databases and registers



Source: Adapted by the authors, 2025

Table 2: Study characteristics and results.

Author, Year, Country	Study Design	Sample / Loss	Mean Age	Outcomes Measured	DAA Results	PA/PLA Results	P values
Barrett WP et al., 2019, USA.[17]	5-year follow-up of randomized controlled trial	Initial n=87; final n=87; losses: 4 at 1 year; 2 deaths at 5 years	DAA: 61.4 ± 9.2; PA: 63.2 ± 7.7	HHS, HOOS Jr, UCLA, survivorship, complications, radiographs	HHS: 96.8 (60–100); HOOS Jr: 95.7 (70–100); UCLA: 6.33 (2–9); survivorship: 100%	HHS: 97.1 (43–100); HOOS Jr: 92.9 (40–100); UCLA: 6.26 (2–9); survivorship: 97.7%	HHS: 0.9417; UCLA: 0.8518; HOOS Jr: 0.2815
Nambiar M et al., 2021, Australia.[18]	Randomized controlled trial with 5-year follow-up	Initial n=73; final n=52; losses due to revision, death, and other surgeries	DAA: 64 ± 11; PA: 66 ± 10	WOMAC, OHS, EQ-5D, 10MWT, complications, survivorship	OHS: 47–48; WOMAC: 3–6; EQ-5D VAS: 95–85; 10MWT stable over time; survivorship: 97%	OHS: 47–48; WOMAC: 2–7; EQ-5D VAS: 95–95; 10MWT stable; survivorship: 97%	Not significant (all p > 0.05)
Ryvkov K et al., 2021, Netherlands.[19]	Randomized controlled trial with 1-year follow-up	Total n=46; no losses	DAA: 62 ± 9; PLA: 63 ± 15	HHS, HOOS, complications	HHS: 51.7 → 98.1; HOOS: 33.4 → 85.2	HHS: 51.2 → 97.4; HOOS: 32.5 → 85.1	Not significant

Abbreviations: DAA = direct anterior approach; PA = posterior approach; PLA = posterolateral approach; HHS = Harris Hip Score; HOOS = Hip disability and Osteoarthritis Outcome Score; UCLA = University of California Los Angeles activity score; OHS = Oxford Hip Score; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; 10MWT = 10-Meter Walk Test; EQ-5D = EuroQol-5D.

Risk of bias

Risk of bias was assessed using the PEDro16 scale, as shown on table 3. The studies used did not present any discrepancies or bias risk, thus meeting the scoring criteria.

Functional outcomes

To assess functional capacity, activity level, quality of life, and pain, Barrett et al.[17] used the HHS, HOOS Jr. (a shorter version of the HOOS), and UCLA activity score. Ryvkov et al.[19] also used HHS and HOOS. Only Nambiar et al.[18] used the WOMAC (function, stiffness, and pain), Oxford Hip Score (function and pain), 10-Meter Walk Test, and EQ-5D20.

All studies that compared DAA and PA reported no significant differences when comparing scores at 1, 2, or 5 years postoperatively. For the UCLA score and HHS, Barrett et al.[17] reported p values of 0.8518 and 0.9417 at five-year follow-up. Considering that HOOS Jr. scores were slightly higher in the DAA group at five years, a Satterthwaite test was applied, which also showed no statistically significant difference (p = 0.2815).

Ryvkov et al.[19] performed a one-year postoperative evaluation and reported p values of 0.58 for HHS and 0.99 for HOOS when comparing DAA and PLA.

Nambiar et al.[18] performed analyses at 1-, 2-, and 5-year follow-ups comparing DAA and PA. For EQ-5D, p values were 0.97, 0.80, and 0.45; for OHS, 0.50, 0.57, and 0.93; for WOMAC, 0.60, 0.30, and 0.96; and for the 10-Meter Walk Test, 0.64, 0.35, and 0.17.

Table 3: Assessment of risk of bias. N: No. Y: Yes.

Article	Barrett WP et al., 2019, USA.[17]	Nambiar M et al., 2021, Australia.[18]	Ryvkov K et al., 2021, Netherlands.[19]
1	N	Y	Y
2	Y	Y	Y
3	Y	Y	Y
4	Y	Y	Y
5	N	N	Y
6	N	N	N
7	Y	N	Y
8	Y	Y	Y
9	N	N	Y
10	Y	Y	Y
11	Y	Y	Y
TOTAL	**7/11**	**7/11**	**10/11**

All studies that compared DAA and PA reported no statistically significant differences at 1-, 2-, or 5-year follow-ups. For the UCLA activity score and HHS, Barrett et al.[17] reported p values of 0.8516 and 0.9417 at five years. Although HOOS Jr. scores were slightly higher in the DAA group at five years, the Satterthwaite test also indicated no statistically significant difference (p = 0.2815). Ryvkov et al.[19] reported no significant differences at one year, with p values of 0.58 for HHS and 0.99 for HOOS when comparing DAA and PLA.

Nambiar et al.[18] reported no significant differences between DAA and PA across all time points. For EQ-5D, p values were 0.97, 0.80, and 0.45 at 1, 2, and 5 years, respectively. For OHS, values were 0.50, 0.57, and 0.93; for WOMAC, 0.60, 0.30, and 0.96; and for the 10-Meter Walk Test, 0.64, 0.35, and 0.17.
All studies reported postoperative complications. In Barrett et al.[17], the PA group presented bursitis, iliopsoas tendinitis, and deep vein thrombosis at two-year follow-up, while the DAA group presented iliopsoas tendinitis and prosthesis dislocation at five years; all events were resolved.

Nambiar et al.[18] reported one revision surgery in each group (PA at three months and DAA at five years). Additionally, decreased sensation of the lateral femoral cutaneous nerve was observed in eight of 23 DAA patients at three months, with partial resolution in four cases at two years.

Two studies assessed implant survivorship. One reported no difference in implant survival at five years (97% for both DAA and PA)18, while Barrett et al.[17] reported survivorship rates of 100% for DAA and 97% for PA at five years. Ryvkov et al.[19] did not perform formal survivorship analysis but reported one revision due to prosthesis dislocation.

Regarding mortality, Nambiar et al.[18] reported one death in the DAA group at two years and two deaths in the PA group at two and five years, in addition to one revision in each group. Barrett et al.[17] reported one death in each group (DAA at 6.6 years and PA at 4.1 years). All studies stated that deaths were unrelated to the surgical procedure. One study reported no loss to follow-up19; however, this must be interpreted considering its shorter follow-up period (one year). Overall, no significant differences in mortality were observed between surgical approaches.

DISCUSSION

Total hip arthroplasty (THA) is a widely used surgical treatment for osteoarthritis, the most common form of joint disease and a major cause of chronic pain and disability in adults.[21] Given that different surgical approaches are available, identifying those with fewer functional impacts remains clinically relevant. In this context, the present review aimed to synthesize and compare postoperative outcomes between THA approaches based on the available evidence.

Main findings of the included studies

The three included randomized controlled trials[17,18,19] consistently reported no statistically significant differences between the direct anterior approach (DAA) and posterior/posterolateral approaches regarding functional outcomes, including HHS, HOOS, WOMAC, UCLA activity score, and gait-related measures across follow-up periods. Although no statistically significant differences were identified, Barrett et al.[17] and Ryvkov et al.[19] reported numerically higher HHS and HOOS scores in the DAA group at certain time points.

Overall, these findings should be interpreted as evidence of clinical comparability rather than superiority between approaches.

Comparison with literature

These results are partially consistent with previous systematic reviews. Higgins et al.[22] reported that in some randomized studies, DAA was favored in functional outcomes such as HOOS and HHS, although findings varied depending on follow-up duration. Similarly, Fagotti et al.[23] observed slightly better short-term functional outcomes for DAA, particularly in HHS, with diminishing differences over time.

However, in contrast to these reports, the present review did not identify consistent superiority of any surgical approach across the included studies, suggesting that differences in functional outcomes remain inconclusive.

Complications and clinical interpretation

Postoperative complications were reported in all included studies, with a total of 15 events in the DAA group and nine in the PA group. However, the distribution of complications varied across studies and surgical approaches.

Barrett et al.[17] and Ryvkov et al.19 reported a higher frequency of complications in the DAA group, particularly lateral femoral cutaneous nerve (LFCN) injury. In contrast, Nambiar et al.[18] reported more complications in the PA group, although all events were resolved during follow-up.

LFCN neuropraxia was the most frequently reported complication associated with DAA across studies[17,19], consistent with previous evidence. Fagotti et al.[23] also identified LFCN injury as the most common minor complication of the anterior approach. In the present review, LFCN symptoms did not appear to influence functional outcome scores, as most cases resolved partially or completely over time.

Limitations and certainty of evidence

Although all included studies were randomized controlled trials, the certainty of evidence remains limited. Only three studies[17,18,19] were included, resulting in a small evidence base. In addition, sample sizes

were relatively small and heterogeneous, and follow-up durations varied substantially (1 to 5 years), limiting direct comparison of outcomes.

Furthermore, variability in outcome measures and reporting methods restricts the ability to perform a more robust synthesis. Therefore, the findings should be interpreted with caution, as they represent low-to-moderate certainty evidence.

Clinical implications and future perspectives

From a clinical perspective, current evidence suggests that DAA, PA, and PLA approaches provide similar functional outcomes and survivorship in THA. Therefore, surgical approach selection should prioritize surgeon experience, patient characteristics, and complication profiles rather than expectations of functional superiority.

Future studies should include larger multicenter randomized controlled trials with standardized outcome measures and longer follow-up periods to strengthen the evidence base and improve certainty regarding comparative effectiveness of THA approaches.

CONCLUSION

The present systematic review compared clinical outcomes of different surgical approaches for total hip arthroplasty (THA). Although some studies reported slightly higher scores in the direct anterior approach (DAA) for physical function, quality of life, and pain-related outcomes, no statistically significant differences were observed between DAA, posterior approach (PA), and posterolateral approach (PLA) across the included studies.

The DAA was associated with a higher incidence of lateral femoral cutaneous nerve (LFCN) injury; however, this complication did not appear to have a relevant impact on functional outcomes or quality of life measures in the included studies.

Given the limited number of included studies, small sample sizes, and variability in follow-up periods, the overall certainty of the evidence is limited. Therefore, no definitive superiority of one surgical approach over another can be established based on the current evidence.

Future research should focus on well-designed multicenter randomized controlled trials with standardized outcome measures and longer follow-up periods to improve the quality of evidence and support clinical decision-making regarding the optimal surgical approach for THA.

LIMITATIONS

The main limitation of this study is the small number of articles reviewed, considering that few updated randomized clinical trials have been carried out specifically using anterior and posterior

approaches for total hip arthroplasty.

DECLARAÇÃO DE CONFLITOS DE INTERESSE

Sem conflito de interesses.

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