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Total Hip Arthroplasty for Dysplastic Coxarthrosis the Use of a Cementless Wagner Funnel Stem

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Abstract **Original Research Article**

Background: Total hip arthroplasty (THA) is presently the quality surgical choice for hip osteoarthritis secondary to developmental hip dysplasia (DDH); it may be extraordinarily challenging, due to the hypoplasic proximal metaphysis, pathological anteversion, and immoderate cervico-diaphyseal perspective of the neck at the femoral facet. The reason of this retrospective study become to evaluate the lengthy-time period survival and medical and radiological outcomes of Conus uncemented stems, implanted in patients affected by hip osteoarthritis with Crowe now not-type IV secondary to DDH. Material and technique: This was a retrospective study has conducted in Department of Orthopedic, UHC sadar, Mymensing. During the period of June 2013 and july 2021. We identified 96 consecutive THAs executed for DDH in 57 women and 26 men, with an average age of 53 years in a single center. 13 sufferers underwent bilateral hip replacement. The patients' suggest frame mass index changed into 29. Eight kg/m2 (range 27.1–35.6 kg/m2). The most important symptoms for surgical treatment had been intense hip pain and huge purposeful impairment: the preoperative Harris Hip Score turned into 29.5 on average (variety 22–61). Radiologically, 8 hips were categorized as Crowe I, 41 hips as Crowe II, and 47 hips as Crowe III. In all cases, we implanted the Wagner femoral cone prosthesis using the direct lateral technique; within the attempt to reestablish local hip biomechanics, sixty six stems have been one hundred thirty five° and 34 were one hundred twenty five°. ***Results:*** The imply observe-up of the take a look at was 11.7 years (range 2.2–21.Eight years). Harris Hip Score expanded to a median value of 71.5 factors (range 52–ninety three points). Radiographic evaluation verified osteointegration of the implant with strong bone increase discovered on the stem–endosteum interface; signs and symptoms of bone readaptation and thinning of the femoral calcar were present in nine hips. None of the sufferers underwent revision for septic or aseptic loosening of the stem; none sustained a periprosthetic fracture. ***Conclusions:*** This take a look at confirms the theoretical blessings that suggest the selection of the Wagner cone whilst technical difficulties at some stage in prosthetic surgical procedure are predicted attributable to unusual proximal femoral anatomy.

Keywords: Hip, Dysplasia, Total hip arthroplasty, periprosthetic, conical stem.

INTRODUCTION

Total hip arthroplasty (THA) is currently the great surgical choice for hip osteoarthritis because of longstanding developmental hip dysplasia (DDH); during surgical treatment, positive issues can be extraordinarily tough, which includes terrible bone inventory on the shallow and roofless acetabular facet and on the hypoplasic proximal metaphysis, with larger anteroposterior diameter in comparison with the mediolateral and pathological anteversion, and undue cervico-diaphyseal angle of the neck at the femoral part. Besides osseous deformities, surrounding smooth tissues may additionally showcase scarring and fibrosis with damaged or significantly contracted muscle groups [1].

Furthermore, pelvic and/or proximal femoral osteotomies could have been achieved formerly in pediatric patient populations within the attempt to accurate structural deformities and to enhance the mechanics of the hip, and therefore decrease pain and reap higher feature [2, 3]. Surgeons need to be aware of preceding scars and must be aware of the area of the hardware that could were left in situ and be prepared to put off it, if required, preserving in thoughts that a

distinct method to the hip, together with the traditional, can be extra advisable. Therefore, primary hip arthroplasty in sequelae of DDH calls for tricky preoperative making plans, have to be considered technically traumatic, and, if the patients require leg lengthening of greater than four cm, shortening osteotomy of the femur is recommended, and particularly challenging in terms of implant survival [4-6].

On the femoral side, the usage of a stem with a rounded segment, whose layout includes a proximally conical and tapered prosthesis for higher load distribution with the sharp longitudinal ribs and the Titanium alloy coarse-blasted surface to enhance stability and osseointegration, must permit immediately fixation within the medullary bony bed and recuperation of the right model attitude in the course of insertion, thanks to its narrow round proximal pass-segment that allows adjustment of the anteversion perspective of the stem, especially in sufferers whose femoral geometry precludes the usage of well known-sized implants and for whom metaphyseal engaging stems are not a great choice due to DDH [7-9]. Finally, being a monoblock, it excludes the theoretical downside of capability for steel corrosion given via modular-designed additives that still may be encouraged to house the shape of the dysplastic canal [2, 10, 11].

The purpose of this retrospective study was to assess the lengthy-term survival and clinical and radiological results of one hundred Conus uncemented stems, implanted in patients suffering from hip osteoarthritis with Crowe not-type IV secondary to DDH.

MATERIALS AND METHODS

This was a retrospective study has conducted in Department of Orthopedic, UHC sadar, Mymensing. During the period of June 2013 and july 2021. We recognized 96 consecutive THAs carried out for DDH in a single middle in which the Wagner Cone stem turned into used; For every affected person, whole medical history turned into amassed. The predominant symptoms for surgical treatment were excessive hip ache and enormous practical impairment, while restoration of leg length discrepancy was not considered as a primary aim. Exclusion criteria blanketed patients with much less than 2-year minimum follow-up, patients with energetic or previous hip joint contamination, and sufferers with records of neuromuscular disease who could not participate in preferred rehabilitation protocols. This study became permitted through the institutional evaluate board at our college. The approval of the ethics committee had now not been requested, in consideration of the retrospective observe layout. Study protocol was according with the Declaration of Helsinki for human studies.

The majority of the sufferers have been female, this is, 57 girls and 26 guys with an average age of 53 years (range 27–88 years); all of them have been identified as white/Caucasian. 13 sufferers underwent bilateral THA consecutively, not concurrently. The proper hip turned into operated in 62 cases, the left in 34. The sufferers' mean frame mass index (BMI) become 29.8 (range 27.1–35.6).

Informed consent was obtained from all patients. Preoperative medical assessment turned into achieved the usage of the Harris Hip Score (HHS); the preoperative HHS was 29.Five on average (range 22–61). For radiological assessment, anteroposterior pelvic radiographs and axial view of the concerned hip were acquired to evaluate the acetabular bone stock, and to estimate the predicted cup insurance and length. Templating become carried out via two fellowship-educated orthopedic surgeons on their respective sufferers to choose the appropriately sized implant. The teardrop at the deformed facet becomes considered because the greater convenient marker of the acetabular cup suitable role. When important, computed tomography (CT) photographs have been used for in addition research, mainly to determine the thickness of the medial wall and of the elusive anterior wall. Although foremost class systems have been proposed to describe the severity of DDH in adults, because they seem to demonstrate top interobserver and intraobserver agreement, as a consequence suggesting the usage of both to boom the preoperative accuracy [12], we primarily based dysplasia assessment on the Crowe type [13]: 8 hips were categorised as Crowe I, 43 hips as Crowe II, 49 hips as Crowe III, and no hips as Crowe IV.

All sufferers had been administered an antibiotic prophylaxis intravenously the usage of 2 g of cefazolin throughout the operation and 1 g each 6 h for a total of three postoperative doses. In widespread, anesthesia or mixed spinal-epidural anesthetic was administered—varying throughout sufferers depending at the anesthesiologist attending, affected person's preoperative comorbidities, and concomitant spinal pathology. All the THAs had been implanted the use of the direct lateral approach (with patient laying in lateral decubitus role on the contralateral unaffected side) in a traditional turbulent go with the flow theater. In overall, 61 tactics have been finished by using the 2 former chiefs of the unit, at the same time as 39 cases were carried out through four surgeons a number of the senior registrars, experienced in joint substitute surgical procedure; not one of the THAs was performed by using a trainee as first medical professional, even below supervision. The primitive acetabulum became reamed in or near the anatomical position, and the acetabular cup was press-fit constant with an meant inclination perspective of forty–50° and an intended anteversion of 10–20°. We implanted only cementless hemispherical cups; the Zimmer-Biomet Continuum shell changed

into the maximum not unusual acetabular thing, used 27 in instances, a Zimmer-Biomet Trilogy shell was used in 22 instances, and a Zimmer-Biomet TMT modular shell changed into utilized in 18 instances. Other acetabular additives used covered Protek Allocor in thirteen cases, Protek Fitek in 10, Sulzer Fitmore in four, Link Top in three, Aesculap Plasmacup in 2, and Centrepulse Allofit in 1. Two or more extra acetabular screws have been used in seventy one instances to implement fixation based at the bone first-class of the patient and the desire of the medical professional, but without any clear correlation with preoperative severity of Crowe classification. None of the cups requisite superolateral bone autograft expansion to increase acetabular coverage. Table 1 summarizes the diameters of the cup implanted, the sizes of the inserted femoral cone stem, the diameters of the top used, and the coupling bearings chosen.

On the femoral aspect, in all cases we implanted the Wagner femoral cone prosthesis (Zimmer-Biomet, Warsaw, IN, USA); it's miles a short, diaphyseal enticing femoral stem, with titanium alloy coarse-blasted floor, with a five° taper, available in specific neck angles (125° and 135°) and with lengths from one hundred.5 mm to one hundred ten mm and in diameters from 6.4 mm to 10.Four mm (distal phase distance: at 96 mm distance from the shoulder of the prosthesis) [14, 15]. In our case series, sixty six THAs had been one hundred thirty five° and 34 were 125° within the try to reestablish local hip biomechanics. In 11 cases, hardware from a previous femoral osteotomy were nonetheless in situ and have been consequently eliminated if important (Fig. 1). A unmarried tray of reamers and limited instrumentation presents a streamlined system for ease of use and turnover in the working room. Progressive conical reamers had been used manually to appropriately broach the femoral medullary canal till resistance in opposition to the inner cortex became felt; bendy reamers were in no way used to open up the canal prior to using them. Because recovery of anteversion is tough to devise preoperatively, physician become guided through intraoperative trial; a blended anteversion that is much less than fifty five° is an effective manner to keep away from dislocation after surgical operation [1]. Thus, the uncemented stem turned into inserted via guiding it with its appropriate tool, aiming to achieve approximately 10–20° of anteversion. The prosthesis become turned around into the favored anteversion and became impacted into its definitive role. Then, the very last femoral head become assembled manually and fixed to the taper of the femoral factor with ok hammer blows. Before closure in layers above one intraarticular drain, the stableness of the hip implant turned into assessed the usage of the shuck check and examining the primary arc range of movement. Perioperative care became the equal for all sufferers: thromboembolic prophylaxis with low-molecular-weight heparin was administered for 5 weeks; in the course of this period, sufferers used compression stockings. No medicinal drugs had been given to save you heterotopic ossifications. Passive movement sports with the assistance of a therapist began right away after the operation, and the single intraarticular suction drain turned into removed on the second one postoperative day. Patients had been unfastened to stroll with helps after three days for approximately 6 weeks, and thereafter, full weight-bearing turned into normally allowed.

From: Total hip arthroplasty for dysplastic coxarthrosis the use of a cementless Wagner funnel stem

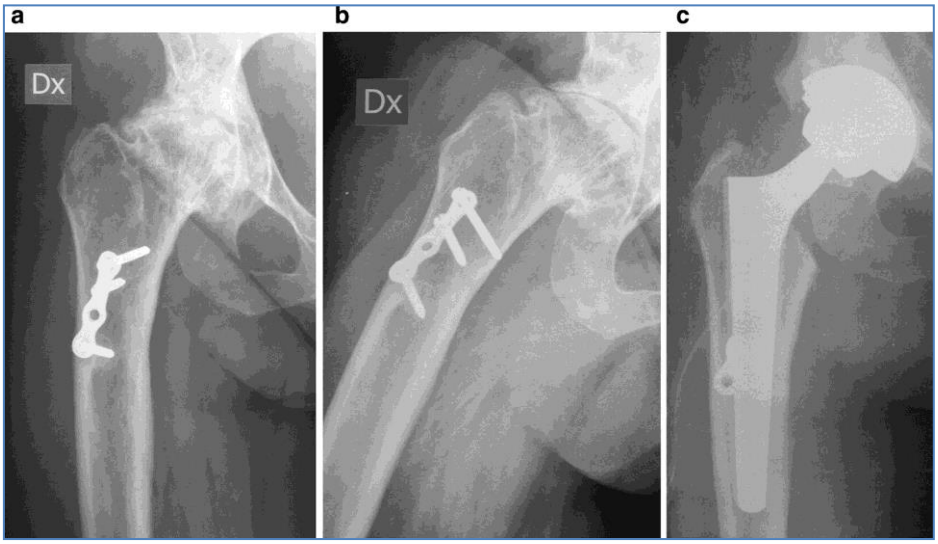

Fig-1: a, b, Preoperative AP view of the hip and lateral view of the femur in a coxarthrosis classified as Crowe I; a femoral proximal osteotomy have been formerly done in another country. C, Postoperative AP view of the operated hip; hardware have been partially left in vicinity

Radiologically, any sign subsidence or tilting/migration of the femoral thing changed into documented. AP pelvis and axial view of the involved hip have been obtained and assessed with the aid of the equal observer, who had not been involved in any treatment of patients enrolled inside the study. The parameters investigated blanketed alignment of the stem, subsidence of the stem, calcar resorption, and development of radiolucent lines. Signs of stem subsidence or tilting/migration round femoral issue had been documented; our cutoff defining vertical migration became set at three mm, as formerly suggested [16]. Radiolucent strains had been recorded the use of Gruen's zones [17]; assessment of the mechanical implant stability finished the research of signs of stress-defensive and osseointegration, as supported with the aid of Engh [18]. Heterotopic ossifications had been labeled in step with Brooker et al. [19]. The orientation of the aspect turned into categorized as valgus, mild valgus, impartial, mild varus, or varus. Slight varus or moderate valgus alignment turned into used to explain a femoral stem with much less than 5° of malalignment with appreciate to the impartial axis of the femoral canal [20].

All eventual local complication, consisting of periprosthetic infection, dislocation, intra- and postoperative periprosthetic fracture, and breakages of the lining and/or of the top, have been recorded. A Kaplan–Meier cumulative survival curve was processed to explain the probability of survival for the Wagner cone femoral stem prosthesis. It was generated by using GraphPad Prism nine Software (GraphPad Software, San Diego, CA, USA) and adopted to assess the survival of the implant each for aseptic loosening and for any motive in patients found from the time of the surgery until the cease of follow-up. A P-cost < zero.05 was considered full-size.

RESULTS

All sufferers finished the HHS at a minimum of 2 years postoperation. The suggest follow-up of the have a look at changed into 11.7 years (variety 2.2–21.8 years). Nine sufferers with eleven THAs died or had been misplaced at the very last observe-up at the examine census date (January 2020); the two sufferers with bilateral THA were misplaced at 11 and 15 years of comply with-up; the final seven patients with unilateral THA no longer eligible were misplaced after five, 8 (patients), 9, 12, 14, and 15 years of comply with-up. Therefore, for the prevailing study, 89 THAs had been eligible in ninety one patients; among those, they all declared that they have been satisfied with the outcomes of surgical procedure, confirmed medical improvement, and walked with none assist at 3 months after surgical operation, showing an increase inside the HHS to a mean fee of seventy one.Five factors (range fifty two–93 points), and not using a massive variations among businesses regarding the preoperative Crowe rating that had caused the operation.

In general, 71 (79. Eight%) stems were located in a neutral alignment, eleven (12.3%) in mild varus, and 7 (7.9%) in mild valgus. Radiographic evaluation tested osteointegration of the implants with stable bone increase discovered on the stem–endosteum interface; symptoms of bone readaptation and thinning of the femoral calcar were found in 9 hips; and pedestal formation changed into in no way discovered. There had been no instances of subsidence exceeding 3 mm or evidence of impending aspect failure, no instances of implant dislocation, and no instances of component breakage. None of the sufferers underwent revision for septic or aseptic loosening of the stem and/or of the cup; none sustained a periprosthetic fracture. No early infection or wound restoration troubles befell.

The Kaplan–Meier curve confirmed a survival rate of the Wagner cone stem of 99.2% (95% CI 92.Eight–100) at five years, 95.1% (95% CI 87.Five–ninety eight.Nine) at 10 years, and 81.3% (95% CI 88.7–66.Four) at twenty years (Fig. 2).

From: Total hip arthroplasty for dysplastic coxarthrosis using a cementless Wagner funnel stem

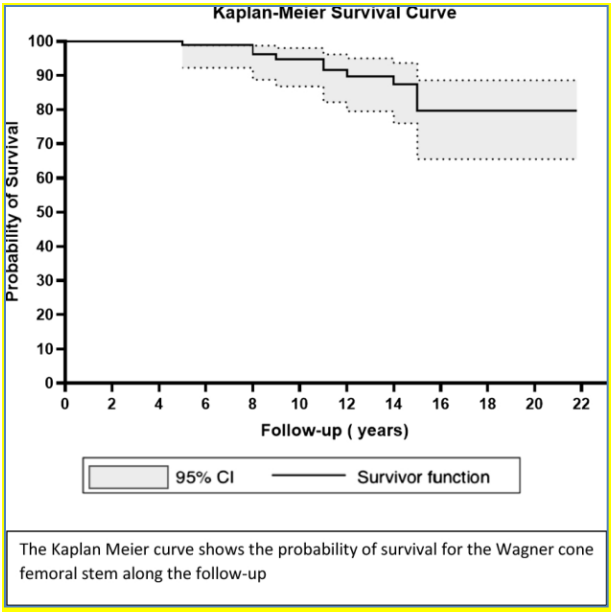

Fig-2: The Kaplan–Meier curve: survival rate of 99.2% at 5 years, 95.1% at 10 years, and 81.3% at 20 years

Heterotopic ossifications were determined in seven (7.Nine%) cases, of which 3 cases have been level 1, three instances stage 2, and one case level 3. No case becomes discovered at degree 4. Ossifications had been advanced inside the first yr of observe-up, with none evident joint dilemma and displaying no modifications over time in all cases. No sufferers required similarly surgical procedure for ossification elimination. One intraoperative worry became stated: one patient skilled an intraoperative fracture of the greater trochanter that was controlled with braided cables and healed with restricting lively abduction and dragging load on the operated limb for 6 weeks. One

affected person underwent a deep venous thrombosis on the fifth postoperative day that resolved without sequelae with medical remedy. Another affected person, 14 years after her THA, had a reoperation for a suspected free acetabular cup (Protek Fitek) because of radiographic evidence of sovra-acetabular osteolysis, which become bone ingrown and left in place; the lytic areas had been packed with morcellized autologous bone graft, and a head and liner trade turned into finished.

DISCUSSION

Coxarthrosis secondary to DDH leads to pathological bony anatomy and severe biomechanical alterations across the hip joint, growing the problem of THA, which remains the treatment of choice for cease-stage arthritis of the hip. In such an strange proximal femoral morphology, a stem with metaphyseal becoming flat-wedge taper or healthy and fill must now not be taken into consideration appropriate [9, 21], whilst a diaphyseal enticing stem that dials in the favored quantity of anteversion is suited, attributable to its functionality of variation in small femurs, with negative metaphyseal bone fine, and possibly with previous hip surgical procedures. Its use must consequently minimize the threat of threatening the long-time period survival of the prosthetic implant associated with aseptic loosening. Furthermore, with a conical prosthesis, initial fixation is secured with the aid of the longitudinal sharp ribs, imparting a uniform axial load transfer, greater proximally than distally, which can also save you strain-defensive and sell proximal osteointegration of the stem.

In our collection, radiological assessment at follow-up showed osteointegration of the stem within the proximal place of the femur, in spite of signs and symptoms of thinning of the femoral calcar in nine hips, and no pedestal formation distally, this phenomenon probably being because of the conical geometry of the implant.

Although poor final results associated with mechanical failure because of subsidence of the femoral thing is a prime situation when the usage of a diaphyseal-becoming implant consisting of the Wagner cone, the revision rate for aseptic loosening of the stem at a median follow-up of eleven.7 years is 0%. This final results is in keeping with formerly mentioned consequences with conical tapered stem: Faldini *et al*. Mentioned that none in their 28 implants had to be revised at a median follow-up of 12 years [22]. In fifty two THAs carried out on patients with a small body and younger than forty years, with an average length of follow-up of seven.7 years, subsidence become found in 3 Wagner cones, however none of the implants were revised [14]. In some other collection of 173 implants with a median observe-up of 87 months, revision was required in two instances attributable to periprosthetic fracture [2]. Revision befell in 2 of 102 complicated hip replacements mixed with femoral shortening osteotomy for Crowe IV DDH, with a survival of ninety five. Nine% at 10 years, within the look at group of Grappiolo *et al*. [5]. According to Zhang, in 59 THAs performed on patients with small or ordinary proximal femoral anatomic proportions with a comply with-as much as 7 years, simplest one patient underwent revision surgical operation as a result of past due contamination, even as no innovative radiolucencies were determined, and radiographic evaluation confirmed stability of all implants [9]. It has been proven that there are fewer implant-associated headaches in sufferers present process THA with a dislocated hip labeled as Crowe kind IV whilst cylindrical stems 2/three lined have been used to reconstruct a step-cut osteotomized femur as compared with tapered stems with 1/three proximal coating [21].

We are well conscious that coxarthrosis secondary to DDH is a analysis that theoretically may reveal the implant to instability, because of the fact that a head with a diameter smaller than 32 mm biomechanically worsens the range of movement and the leap distance turns into shorter, main to subluxation and/or dislocation. In osteoarthritis secondary to developmental dysplastic hip, a cup with a small diameter is regularly implanted, and using a femoral head with a diameter of 28 mm is a mandatory choice due to the fact the diameter of the femoral head is strictly related to the outer diameter of the cementless shell. Theoretically, prosthetic heads want to be enlarged to obtain better stability, which might suggest that the lining thickness became thinner; a lower inside the polyethylene liner thickness or a lower inside the head-liner conformity results in higher height touch stresses, smaller contact regions, and, consequently, decrease biomechanical wear component [23, 24]. In this record, the use of a femoral head diameter of 28 mm changed into reserved for 56 of the a hundred implants, especially because the outer diameter of the cementless shell became 48 mm or less in forty six THAs. We have registered no cases of dislocation; in our opinion, it's miles probably related to 3 predominant factors that could defend from this difficulty: the selection of the direct lateral method, the small numbers of hips that had had preceding proximal femoral osteotomy, and, normal, the fact that none of the operations have been completed on Crowe IV hips. In such excessive dislocated hips, modular stems may be used and often in addition surgeries are required, inclusive of femoral metaphyseal subtrochanteric shortening osteotomy to balance the leg period and pelvic obliquity, and every so often trochanteroplasty in an attempt to avoid impingement among the trochanter and iliac wing, as a consequence main to excessive risk of instability [1-6, 11, 15, 25-27].From: Total hip arthroplasty for dysplastic coxarthrosis using cement less Wagner funnel stem

Table-1: Implant features

Size of arthroplasty	Number
Diameter of cup (mm)	
58	2
56	6
54	7
52	11
50	26
48	12
46	12
44	14
Total	96
Size of stem (mm)	
24	3
23	2
22	6
21	4
20	7
19	10
18	11
17	14
16	24
15	11
14	4
Total	96
Diameter of head (mm)	
36	6
32	36
28	54
Total	96
Coupling bearing	
Ceramic-on-polyethylene	55
Metal-on-polyethylene	21
Ceramic-on-ceramic	20
Total	96

There are some limitations to this study. Firstly, there is inherent bias in retrospective studies based on the design, with eleven implants of the initial a hundred THAs misplaced on the final observe-up. Secondly, there's no control institution with other femoral implants. Thirdly, it took a long term to collect a hundred THAs, performed via six one-of-a-kind surgeons, although the use of the identical method, in all likelihood due to the fact the range of patients enrolled on this have a look at was restrained via the range of surgeons worried in the operations. Finally, we've got no longer measured vital clinical and biomechanical parameters along with leg period discrepancy and femoral offset, even if their development may be postulated because of all of the implants having been stable on the brand new observe-up.

CONCLUSION

This take a look at confirms the theoretical benefits that propose the choice of the Wagner cone and may aid its utility whilst technical difficulties at some point of prosthetic surgical procedure are anticipated because of atypical proximal femoral anatomy.

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