

Current Femoral Stem Fixation Selection in Hip-Fracture Bipolar Hemiarthroplasties, and Factors Affecting Surgeons' Confidence in Their Ability to Teach about Cemented Stems: A Questionnaire in a Region of Japan with Super-Aged Patients

Takanori Miura^{a, b*}, Hiroaki Kijima^{b, c}, Hiroshi Tazawa^{b, d}, and Naohisa Miyakoshi^{b, c}

^aDepartment of Orthopedic Surgery, Tazawako Hospital, Semboku, Akita 014-1201, Japan, ^bAkita Hip Research Group,

^cDepartment of Orthopedic Surgery, Akita University Graduate School of Medicine, Akita 010-8543, Japan,

^dDepartment of Orthopedic Surgery, Akita Red Cross Hospital, Akita 010-1495, Japan

Japan's hip fracture management guidelines now recommend the use of cemented stems in cases of bone fragility. However, the current stem selection practices in bipolar hemiarthroplasty (BHA) in a super-aging area in Japan remain unclear. This study aimed to examine the stem selection policies, the surgeons' concerns about cemented stems, and factors affecting their confidence in their ability to coach others on cemented stem procedures. Ninety-four orthopedic surgeons (27 facilities) responded to our web-based questionnaire conducted in January/February 2022. Cementless stem was the first choice of 97.8% of the surgeons; <15% of the respondents expected to increase their use of cemented stems in the future. The cement technique was the greatest concern; almost half of the surgeons described having insufficient experience with cemented stems. The factor that most affected the surgeons' expertise in using cemented stems is the number of surgeries they had conducted with a cemented stem (multivariable analysis odds ratio 8.42, $p=0.001$). Greater experience was associated with increased expertise of the surgeons in using cemented stems, with a threshold of 11 cases showing sensitivity of 41.7% and specificity of 98.3% for their confidence to instruct cemented stems.

Key words: hip fracture, arthroplasty, bone cement, questionnaire

Hip fractures in the elderly are a global problem that is increasing, and such cases are becoming a substantial socioeconomic burden on healthcare systems [1]. For the treatment of displaced femoral neck fractures, hip arthroplasties including bipolar hemiarthroplasty (BHA) and total hip arthroplasty have provided good results compared to internal fixation, allowing earlier mobilization, fewer reoperations, and better functional outcomes [2, 3]. However, when it is necessary to fix a BHA implant to the bone of the femur, the decision whether to use a cementless or cemented

stem still depends on the surgeon's discretion, and the selection remains controversial [4-6].

Traditionally, a cemented stem is preferred in elderly patients [7]. However, cementless stems have the advantages of reduced blood loss, shorter operative time, and a lower risk of cardiovascular events associated with cement use [4, 5, 8, 9], and their use in total hip arthroplasty is increasing worldwide [10]. Several cementless stems have been designed to provide better integration with the bone [11]. However, the use of a cementless stem poses a higher risk of intraoperative and postoperative periprosthetic fractures compared to cemented

Received October 25, 2022; accepted January 20, 2023.

*Corresponding author. Phone: +81-187-43-1131; Fax: +81-187-43-1466
E-mail: tmlucky8@gmail.com (T. Miura)

Conflict of Interest Disclosures: No potential conflict of interest relevant to this article was reported.

stems [8,12,13], and guidelines in the U.S. and UK recommend the use of cemented stems for hip fractures in elderly patients [14,15]. The guidelines in Japan for the management of hip fractures were revised in 2021 to recommend the use of a cemented stem in cases of bone fragility [16]. The use of cemented stems in Japan may thus increase in accord with the revised guidelines.

The application of cemented stems requires a specialized technique known as the “modern cement technique” to achieve good long-term results [17-19]. The choice of whether to use a cemented stem or a cementless stem is likely to involve multiple factors, including the surgeon and senior surgeons’ policies, preferences, specialty, and experience. We speculated that a survey of general orthopedic surgeons’ current stem selection strategy, their concerns about using cemented stems, and factors affecting surgeons’ confidence in their ability to supervise cemented stems would provide helpful information about the use of cemented stems. In this study, we conducted a web-based questionnaire survey about stem selection in a ‘super-aging’ prefectural area in Japan (in which 38.1% of the population is >65 years old) [20], and we obtained important data regarding the stems used for femoral neck fractures by hip surgeons after the 2021 revision of the guidelines.

Materials and Methods

A web-based questionnaire was distributed via Google Forms to orthopedic surgeons working in medical institutions (including university hospitals, community hospitals, and clinics) in Akita prefecture (population ~930,000). The questionnaire was designed by three orthopedic surgeons who specialize in hip joints and are board-certified by the Japanese Orthopedic Association; it was comprised of the 15 questions presented in Table 1.

We surveyed the participating surgeons’ characteristics, their experience with BHA and cemented stems, their current first choice of stem fixation, complications, concerns about cemented stem usage, and the surgeons’ feelings about their ability to coach other orthopedic surgeons on the use of a cemented stem. We classified the surgeons’ experience with BHA and their experience with cemented stems into four categories: 0, 1-10, 11-50, and ≥ 51 cases. The survey was conducted from January 14-to February 28, 2022. All collected questionnaires were tabulated by one of the

authors (T.M.).

We also examined the femoral stems used in BHAs by hip surgeons for femoral neck fractures from January to December 2021 at nine institutions. We classified the femoral stems according to the cementless and cementless short stem classifications described by Khanuja *et al.* [21,22]. Cemented and full hydroxyapatite (HA)-coated stems were also classified separately.

All continuous variables are expressed as the mean \pm standard deviation (SD), and categorical variables are expressed as percentages. The χ^2 -test or Fisher’s exact test were used to assess the difference in proportions. A multiple logistic regression analysis was performed to identify factors associated with the surgeons’ confidence in their ability to teach the use of cemented stems to other orthopedic surgeons. Sensitivity and specificity of the number of cemented stem cases required for surgeons to procure enough experience to coach other surgeons on cemented stems was calculated. The results were verified using R ver. 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at $p < 0.05$.

Ethical approval for this study was obtained from the Institutional Review Board of Tazawako Hospital (approval No. 2022-3). This study was conducted in accord with the principles of the Declaration of Helsinki. All procedures were carried out with the adequate understanding and written consent of each subject.

Results

Questionnaire. A total of 94 orthopedic surgeons (86 males and eight females) from 27 facilities completed the questionnaire during the study period, providing a response rate of 53.7%. Fifteen of the surgeons were in practice at a university hospital, 74 were at 22 community hospitals, and the remaining five surgeons were at five private clinics. The mean number of years of experience as an orthopedic surgeon was 16.6 (1-45) years, and the surgeons’ specialty areas were the spine (22.3%), knee (17%), hip (16%), upper extremities (11.7%), foot (5.3%), and ‘other’ (27.7%) (Fig. 1).

Figure 2 shows the percentage of cases of BHA and cemented stems. Among the 94 surgeons, 83.0% had performed 11 or more BHAs. However, 38.3% of the surgeons had never performed a cemented stem BHA, and 44.7% had performed only 1-10 such cases. Thus, 83.0% of the orthopedic surgeons had performed fewer

Table 1 The questionnaire distributed to orthopedic surgeons in Akita, Japan in January/February 2022 regarding their use of and thoughts concerning the use of cemented and cementless stems in bipolar hemiarthroplasty

Q.1 How many years of experience do you have as an orthopedic surgeon? (free description)

Q.2 What is your orthopedic specialty areas?
 Spine Hip Upper limb Knee Foot & Ankle Other

Q.3 How many BHA have you performed?
 >50 11-50 1-10 0

Q.4 How many surgeries using cemented femoral stem have you performed?
 >50 11-50 1-10 0

Q.5 What is your current first choice of cement or cementless fixation of femoral stem in BHA?
 cement cementless

Q.6 The reason of current femoral stem fixation choice (multiple choice)
 familiar technique good initial stability longer survival rate
 less complication other (free description)

Q.7 Have you experienced any complications with cementless femoral stems?
 Yes No

Q.8 If yes in Q.5, what complications have you experienced? (multiple choice)
 intraoperative or early postoperative periprosthetic fracture subsidence
 loosening malposition of implant other (free description)

Q.9 Which of the following cases would you consider using cemented stem? (multiple choice)
 wide femoral canal porotic bone comminuted fractures
 other (free description) do not use cemented stem

Q.10 Have you experienced any complications with cemented femoral stems?
 Yes No

Q.11 If yes in Q.9, what complications have you experienced? (multiple choice)
 intraoperative or early postoperative periprosthetic fracture subsidence
 loosening malposition of implant other (free description)

Q.12 What are your concerns about using cemented femoral stem? (multiple choice)
 cement technique implant position cement-hardened before stem insertion
 longer operation time BCIS other (free description)

Q.13 Will you increase the use of cemented femoral stem according to revised national guidelines?
 Yes, I will firstly choose cemented stem Yes, I will increase the cemented stem
 Partly agree, I will choose cemented stem if necessary No, I will only use cementless stem.

Q.14 Can you instruct cemented stem to other orthopedic surgeons?
 Yes Possible, depending on experience of surgeon No

Q.15 What are your concerns about instructing cemented stem? (multiple choice)
 management of intraoperative fracture management of implant-malposition
 less experience of cemented stem other (free description)

BHA, bipolar hemiarthroplasty; BCIS, bone cement implantation syndrome

than 10 BHAs with cemented stems.

In response to Q.5 on the questionnaire (“What is your current first choice of cement or cementless fixation of femoral stem in BHA?”), 97.8% of the surgeons responded that a cementless stem was their current first

choice for use in a BHA. In response to Q. 6 (“The reason of current femoral stem fixation choice”), the most common reason for choosing cementless fixation was familiarity with the technique (88.2%) followed by fewer complications (18.1%), a longer survival rate (5.4%),

and good initial stability (3.2%) (Table 2). The free-description section of the questionnaire revealed surgeons' unfamiliarity with cemented stems, not feeling the necessity of using cemented stems, and concern about pulmonary embolization with cemented stems. In response to Q.7 ("Have you experienced any complications with cementless femoral stems?"), 57.4% of the surgeons responded that they experienced complications during the cementless stem procedure, whereas in response to Q.10 ("Have you experienced any complica-

tions with cemented femoral stems?"), only 17.0% described encountering complications during the use of a cemented stem.

Table 3 summarizes the results of the comparison of the experienced complication rate between the cementless and cemented stems. Regarding their use of cementless stems, significantly more of the respondents described an intraoperative or early postoperative periprosthetic fracture (75.9% vs. 12.5%, $p < 0.001$) and subsidence (37.0% vs. 0%, $p = 0.003$). However, the following were significantly more common in the use of

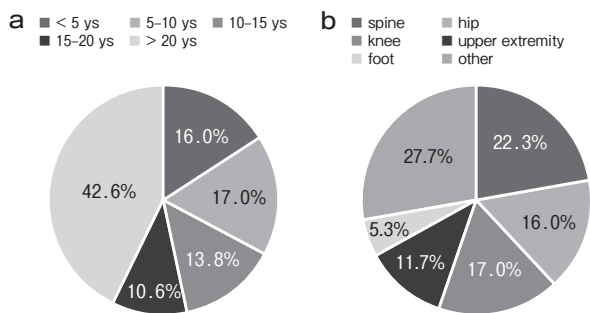


Fig. 1 The experience and specialty areas of the orthopedic surgeons who responded to the study questionnaire. **a**, The orthopedic surgeons' years of experience (n=94); **b**, The surgeons' specialty areas. ys, years.

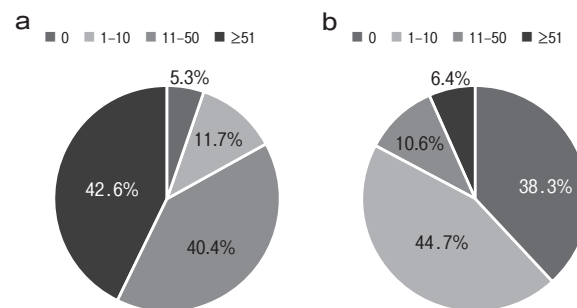


Fig. 2 The percentage of cases of bipolar hemiarthroplasty (BHA) and cemented stems. **a**, BHA cases; **b**, Cases in which a cemented stem was used in a BHA.

Table 2 The surgeons' responses to the questionnaire's multiple-choice items

Questionnaire item	Answer	Values (%)	Questionnaire item	Answer	Values (%)
Q.6 The reason of current femoral stem fixation choice	Familiar technique	88.2%	Q.12 Concerns about using cemented stem	Cement technique	60.6%
	Good initial stability	3.2%		Implant position	48.9%
	Longer survival rate	5.4%		Cement trouble	54.2%
	Less complication	18.1%		Longer operation time	21.3%
Q.9 Favorable case of cemented stem	Wide femoral canal	48.9%	Q.15 Concerns about instructing cemented stem	BCIS	43.6%
	Porotic bone	34.0%		Management of fracture	8.5%
	Comminuted fractures	26.6%		Management of malposition	30.9%
	Do not use cemented stem	18.1%		Less experience	41.5%

BHA, bipolar hemiarthroplasty; BCIS, bone cement implantation syndrome

Table 3 Comparison of the proportion of orthopedic surgeons who experienced complications between cementless and cemented stems in bipolar hemiarthroplasty

	Cementless	Cemented	P-value
N	54	16	
intraoperative or early postoperative periprosthetic fracture	41 (75.9)	2 (12.5)	<0.001
Subsidence	20 (37.0)	0 (0)	0.003
Loosening	8 (14.8)	1 (6.3)	0.369
Malposition of implant	1 (1.9)	6 (37.5)	<0.001
Others	4 (7.4)	11 (68.8)	<0.001

Data are n (%).

cemented stems: malposition of the implant (1.9% vs. 37.5%, $p < 0.001$) and other complications (7.4% vs. 68.8%, $p < 0.001$). Other complications involved problems with the cementing techniques, such as early cement hardening and a lack of cement mantle. In response to Q. 9 (“Which of the following cases would you consider using cemented stem?”), a wide femoral canal was most common (48.9%), followed by porotic bone (34.0%), comminuted fracture (26.6%), and the response that the surgeon did not use a cemented stem (18.1%) (Table 2).

Concerning Q.12 (“What are your concerns about using cemented femoral stem?”), the cement technique was the most often-cited concern about using a cemented stem (60.6%) (Table 2). Regarding Q.13 (“Will you increase the use of cemented femoral stem according to revised national guidelines?”), most of the surgeons still preferred using cementless stems (partly agree: “I will choose a cemented stem if necessary”: 83.0%; “I use only cementless stems”: 2.1%) (Fig. 3). Regarding Q.14 (“Can you instruct cemented stem to other orthopedic surgeons?”), 39.3% of the respondents answered that they felt that they could instruct other surgeons about how to use a cemented stem, and 91.3% of the facilities (23 facilities in total without clinics) were affiliated with the surgeons who provided this answer (Fig.3). In response to Q.15 (“What are your concerns about instructing cemented stem?”), feeling insufficiently experienced was the most common concern about instructing other surgeons on the use of a cemented stem (41.5%), followed by the management of implant malposition (30.9%) (Table 2).

The univariable analysis identified the following as factors that are significantly associated with the respondents’ capability to instruct other surgeons about the use of cemented stems: the years of experience as an orthopedic surgeon (odds ratio [OR] 1.10, $p < 0.001$), status as a hip surgeon (OR 17.82, $p < 0.001$), the number of

BHA surgeries performed (OR 2.44, $p = 0.005$), and the number of surgeries using a cemented stem (OR 13.31, $p < 0.001$). The multivariable analysis revealed the number of years of experience as an orthopedic surgeon (OR 1.10, $p = 0.005$) and the number of surgeries using a cemented stem (OR 8.42, $p = 0.001$) as the two factors significantly affecting the respondents’ capability to instruct other surgeons about the use of cemented stems (Table 4).

Figure 4 shows the number of cemented stems used and responses regarding the capability of instructing cemented stem (Fig.4). The proportion of doctors who answered that they could instruct cemented stems increased with the number of cases. When the cutoff value was set as more than 11 cases, the sensitivity was 41.7%, and specificity was 98.3% for instructing cemented stems.

Survey of femoral stems used at the facilities employing hip surgeons. Of 365 BHA procedures performed at our affiliated institutions, 226 (61.9%) were performed in 2021 at nine of the responding insti-

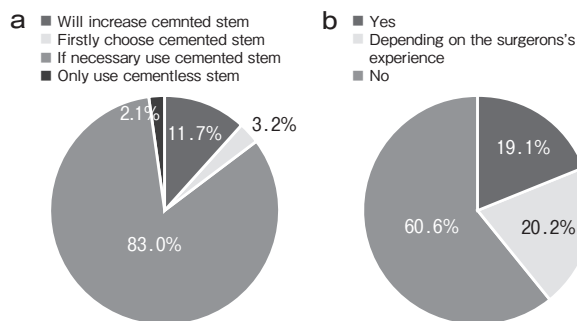


Fig. 3 The surgeons’ willingness to increase the use of cemented stems, and the surgeons’ confidence in their ability to instruct other surgeons about the use of a cemented stem. **a**, The surgeons’ responses to Q.13: “Will you increase the use of cemented femoral stem according to revised national guidelines?”; **b**, The surgeons’ responses to Q.14: “Can you instruct cemented stem to other orthopedic surgeons?”

Table 4 Results of the univariable and multivariable analyses of factors affecting the orthopedic surgeons’ ability to instruct other surgeons about the use of a cemented stem

Variables	Univariable			Multivariable		
	OR	95% CI	P-value	OR	95% CI	P-value
Years of experience as an orthopedic surgeon	1.10	1.05–1.16	<0.001	1.10	1.03–1.18	0.005
Hip surgeon	17.82	4.51–119.6	<0.001	8.39	0.98–71.50	0.052
Number of surgeries of BHA	2.44	1.36–4.79	0.005	1.68	0.82–3.45	0.157
Number of surgeries of cemented stem	13.31	4.91– 55.14	<0.001	8.42	2.36–30.00	0.001

BHA, bipolar hemiarthroplasty; OR, odds ratio; CI, confidence interval

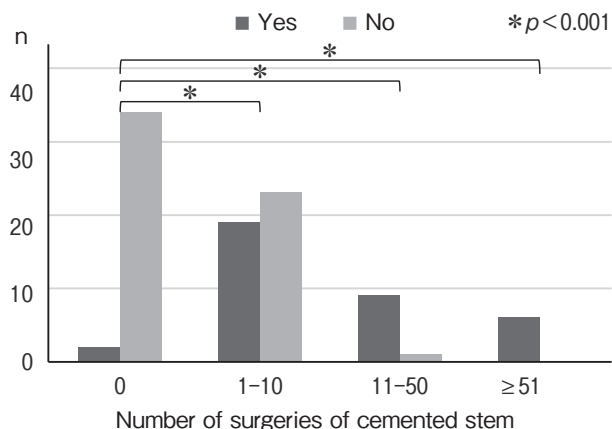


Fig. 4 The number of cemented stems used and response regarding capability of instructing cemented stem. The proportion of surgeons who answered that they could instruct cemented stems is 5.6% (2/36) in the 0 surgeries group, 45.2% (19/42) in the 1-10 surgical cases group, 90.0% (9/10) in the 11-50 surgical cases group, and 100% (6/6) in the more than 51 surgical cases group.

tutions. In approximately 50% of the cases, a single-wedge stem was used, and only 11 cases (4.9%) involved a cemented stem (Fig. 5). All of the short stems were type 4, with shortened conventional tapered stems [22]. There were no intraoperative fractures, but two cases of a periprosthetic fracture due to a fall from a height occurred in the group of single-wedge stem use. Dislocation occurred in two single-wedge stem cases and one tapered-rectangular stem case. Infection occurred in a single-wedge stem case.

Discussion

We investigated the current stem selection strategy, the surgeons' concerns about using cemented stems, and factors affecting surgeons' confidence in their ability to coach other surgeons on the use of cemented stems by distributing a questionnaire to general orthopedic surgeons in the super-aging region of Akita, Japan. We did so in part to determine the rate of femoral stem use by hip surgeons for femoral neck fractures after the 2021 revision of Japan's guidelines. The responses to the survey demonstrated that cementless stems were the first choice for 97.8% of the surgeons, and the hip surgeons used a cemented stem in only 4.9% of the cases. Moreover, only 14.9% of the 94 respondent orthopedic surgeons expected to increase their use of cemented stems in the future.

The cement technique was the most common con-

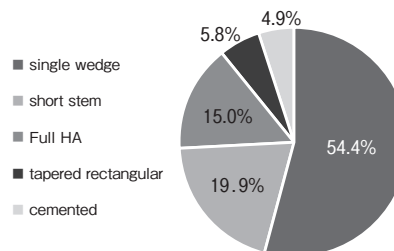


Fig. 5 Survey of femoral stems used at the facilities in Akita, Japan employing hip surgeons in 2021. A single wedge stem was the most commonly used (54.4%, n = 123), followed by short stems (19.9%, n = 45), full HA (15%, n = 34), tapered rectangle (5.8%, n = 13), and cemented stems (4.9%, n = 11).

cern regarding the use of a cemented stem (60.6%), and 41.5% of the questionnaire respondents felt that they had insufficient experience with cemented stems. The multivariable analysis established that the number of surgeries using a cemented stem was the factor that most strongly affected the surgeons' confidence in their ability to coach other surgeons about the use of cemented stems.

The reasons for selecting a cementless stem for a BHA were the surgeons' familiarity with the surgical technique and their belief that there would be fewer complications than with cemented stems; however, the respondents' answers demonstrated that the experience rate of periprosthetic fractures and subsidence was significantly higher in the use of cementless stems, and thus the features of cementless stems need to be considered. Cementless stems generally do not require additional procedures for cement insertion, thus resulting in shorter operative times [23]. A large variety of cementless-stem designs and stabilization methods are available, thus requiring the selection of the optimal stem design to obtain good initial stability in each patient [23-25]. Orthopedic surgeons therefore need to understand the principles of stem design, such as stem geometry and the location of femoral fixation [21, 22].

In contrast, cemented stems provide good initial fixation regardless of bone morphology, less periprosthetic fractures and postoperative thigh pain, better quality of life, and lower cost than cementless stems, and they have health economic advantages [6, 16, 23, 24, 26]. Although the rate of periprosthetic fractures in the use of cemented stems is relatively low, the mortality rate at one-year post-surgery is as high as 34% in hemiarthroplasty patients [27]. Surgeons should

thus be cautious when choosing a cementless stem, and it is important to recognize the differences between the fixation methods of cemented and cementless stems.

Only 14.9% of the 94 orthopedic surgeons responded that they would increase their use of cemented stems in the future; this could be because majority of the respondents had concerns about the cementing technique and had less experience with cemented stems. At the time of the early 2022 survey, 97.8% of the surgeons responded that cementless stems were currently their first choice; this is likely to be because they had received surgical training regarding cementless stems and had experience with successfully performing the surgery with cementless stems. However, approximately half of the respondents indicated that they are aware that cemented stems are more often recommended in cases such as those involving a wide femoral canal or porotic bone. Therefore, the cementing technique and the management of implant malposition, which the surgeons addressed as concerns about using cemented stems, may be the reasons why cemented stems are not widely used among the questionnaire respondents.

In fact, it was reported that orthopedic surgeon trainees in the U.S. feel prepared to cement a femoral component, but they perceive that they have not received sufficient training in the cement technique [28]. In this region, even the supervisory surgeons reported feeling that they have insufficient experience with cemented stems (41.5%) and are concerned about the management of implant malposition (30.9%). This indicates that to increase the use of cemented stems in this region of Japan, supervising surgeons should also perform more cemented stem surgeries.

The present multivariable analysis showed that the number of surgeries using cemented stems had the largest effect on the surgeons' confidence in their ability to supervise other surgeons about the use of cemented stems. Regarding the cutoff value for the capability of instructing cemented stems, specificity was 98.3% when the surgeons had performed more than 11 cases of cemented stem procedures. More than 11 cases' experience is thus desirable as the target number of cases for supervising surgeons. In light of these issues, it is necessary to establish comprehensive education programs, explore teaching methodologies for cementation, and provide cement-technique training workshops for residents, and to provide workshops about the 'cement-in-

cement' and 'in-cement' methods used in stem revision procedures for supervising surgeons [29, 30].

This study has several limitations; the first is sampling bias, since this was a questionnaire distributed to all of orthopedic surgeons in a single region in Japan. Different results may be obtained in other regions, countries, and specialized areas of orthopedic surgeons. Second, it is difficult to survey the actual number of BHA surgeries and thus use of cemented stems among individual surgeons. A survey regarding the actual number of BHA surgeries is needed to determine the cutoff value required to design appropriate training programs for cemented-stem use and to produce a learning curve. Third, osteoporosis treatment affects the occurrence of femur neck fractures and is also important for the prevention of secondary fractures, which was not assessed in this study. Finally, the ability to become a coach for other surgeons regarding the application of cemented stems is a subjective perception of individual surgeons. To evaluate the experience required to become an instructor for a surgery, the cutoff for volume plotted against adverse events is needed. Further large-sample, well-designed, prospective investigations are necessary to assess surgeons' actual teaching ability and to conduct a survey regarding the exact number of surgeries using a cemented or cementless stem. Nevertheless, despite these limitations, we believe that the present survey has clinical relevance and provides insights into general orthopedic surgeons' current practice concerning femoral stem fixation in BHA, their perception about the use of cement, and factors affecting the surgeons' ability to become a cement technique instructor.

In summary, (i) the vast majority of the respondent surgeons select a cementless stem as the first choice, (ii) the cement technique was the greatest concern discouraging the use of cement stems, and (iii) most of the surgeons felt that they had insufficient experience with cemented stems; (iv) the number of surgeries using a cemented stem was the most common factor affecting the surgeons' confidence in their ability to coach other surgeons on cemented stems. To allow surgeons to make the appropriate stem selection in each case, it is necessary to establish comprehensive education programs and explore teaching methodologies regarding cementation.

Acknowledgments. We thank Natsuo Konishi, Hitoshi Kubota, Norio Suzuki, Keiji Kamo, Ken Sasaki, and Yosuke Iwamoto for providing data on the patients and insightful discussions. We also thank Shin Yamada, Takayuki Tani, Masashi Fujii, Tetsuya Kawano, Itsuki Nagahata, and Shun Igarashi for their insightful discussion.

We want to express our deepest gratitude to the Scientific Research WorkS Peer Support Group (SRWS-PSG) for their aid in the present study.

References

- Johnell O and Kanis JA: An estimate of the worldwide prevalence, mortality and disability associated with hip fracture. *Osteoporos Int* (2004) 15: 897–902.
- Frihagen F, Nordsletten L and Madsen JE: Hemiarthroplasty or internal fixation for intracapsular displaced femoral neck fractures: randomised controlled trial. *BMJ* (2007) 335: 1251–1254.
- Parker MJ and Gurusamy KS: Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults. *Cochrane Database Syst Rev* (2006) 2006: CD001708.
- Figved W, Opland V, Frihagen F, Jervidal T, Madsen JE and Nordsletten L: Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures. *Clin Orthop Relat Res* (2009) 467: 2426–2435.
- Ng ZD and Krishna L: Cemented versus cementless hemiarthroplasty for femoral neck fractures in the elderly. *J Orthop Surg (Hong Kong)* (2014) 22: 186–189.
- Fernandez MA, Achten J, Parsons N, Griffin XL, Png ME, Gould J, McGibbon A and Costa ML; WHITE 5 Investigators: Cemented or uncemented hemiarthroplasty for intracapsular hip fracture. *N Engl J Med* (2022) 386: 521–530.
- Elmenshawy AF and Salem KH: Cemented versus cementless bipolar hemiarthroplasty for femoral neck fractures in the elderly. *EFORT Open Rev* (2021) 6: 380–386.
- Langslet E, Frihagen F, Opland V, Madsen JE, Nordsletten L and Figved W: Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: 5-year followup of a randomized trial. *Clin Orthop Relat Res* (2014) 472: 1291–1299.
- Movrin I: Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: A randomized controlled trial with two years follow-up. *Acta Orthop Traumatol Turc* (2020) 54: 83–88.
- Troelsen A, Malchau E, Sillesen N and Malchau H: A review of current fixation use and registry outcomes in total hip arthroplasty: The uncemented paradox. *Clin Orthop Relat Res* (2013) 471: 2052–2059.
- Nantha Kumar N, Kunutsor SK, Fernandez MA, Dominguez E, Parsons N, Costa ML and Whitehouse MR: Effectiveness and safety of cemented and uncemented hemiarthroplasty in the treatment of intracapsular hip fractures. *Bone Joint J* (2020) 102-B: 1113–1121.
- Taylor F, Wright M and Zhu M: Hemiarthroplasty of the hip with and without cement: a randomized clinical trial. *J Bone Joint Surg Am* (2012) 94: 577–583.
- Parker MJ and Cawley S: Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip: a randomized trial of 400 patients. *Bone Joint J* (2020) 102-B: 11–16.
- Ftough S, Morga A and Swift C; Guideline Development Group: Management of hip fracture in adults: summary of NICE guidance. *BMJ* (2011) 342: d3304.
- Brox WT, Roberts KC, Taksali S, Wright DG, Wixted JJ, Tubb CC, Patt JC, Templeton KJ, Dickman E, Adler RA, Macaulay WB, Jackman JM, Annaswamy T, Adelman AM, Hawthorne CG, Olson SA, Mendelson DA, LeBoff MS, Camacho PA, Jevsevar D, Shea KG, Bozic KJ, Shaffer W, Cummins D, Murray JN, Donnelly P, Shores P, Woznica A, Martinez Y, Boone C, Gross L and Sevarino K: The American Academy of Orthopaedic Surgeons evidence-based guideline on management of hip fractures in the elderly. *J Bone Joint Surg Am* (2015) 97: 1196–1199.
- Working group on guidelines for the management of hip fractures, editor. *Japanese Orthopaedic Association (JOA) Clinical Practice Guideline on the Management of Hip fractures*. 3rd ed. Tokyo, Japan: Nankodo (2021) pp 64–70.
- Herberts P and Malchau H: How outcome studies have changed total hip arthroplasty practices in Sweden. *Clin Orthop Relat Res* (1997) 344: 44–60.
- Scanelli JA, Reiser GR, Sloboda JF and Moskal JT: Cemented femoral component use in hip arthroplasty. *J Am Acad Orthop Surg* (2019) 27: 119–127.
- Mulroy RD and Harris WH: The effect of improved cementing techniques on component loosening in total hip replacement. An 11-year radiographic review. *J Bone Joint Surg Br* (1990) 72: 757–760.
- Reiwa 3rd Year Population of Akita Prefecture-Akita Prefecture Population Flow Survey Report by Age- | Beauty Country Akita Net [Internet] [cited 2022 Jul 9]. Available from: https://www-pref-akita-ig.jp.translate.google/pages/archive/44493?_x_tr_sl=ja&_x_tr_tl=en&_x_tr_hl=en
- Khanuja HS, Vakil JJ, Goddard MS and Mont MA: Cementless femoral fixation in total hip arthroplasty. *J Bone Joint Surg Am* (2011) 93: 500–509.
- Khanuja HS, Banerjee S, Jain D, Pivec R and Mont MA: Short bone-conserving stems in cementless hip arthroplasty. *J Bone Joint Surg Am* (2014) 96: 1742–1752.
- Li L, Zhao X, Yang X, Yang L, Xing F and Tang X: Cemented versus uncemented hemiarthroplasty for the management of femoral neck fractures in the elderly: a meta-analysis and systematic review. *Arch Orthop Trauma Surg* (2021) 141: 1043–1055.
- Santini S, Rebeccato A, Bolgan I and Turi G: Hip fractures in elderly patients treated with bipolar hemiarthroplasty: Comparison between cemented and cementless implants. *J Orthop Trauma* (2005) 6: 80–87.
- White CA, Carsen S, Rasuli K, Feibel RJ, Kim PR and Beaulé PE: High incidence of migration with poor initial fixation of the Accolade® stem. *Clin Orthop Relat Res* (2012) 470: 410–417.
- Wu X, Wang Y, Sun W and Tan M: Cemented and uncemented hemiarthroplasty for femoral neck fracture in elderly patients: a systematic review and meta-analysis. *Aging Clin Exp Res* (2021) 33: 2087–2111.
- Phillips JRA, Moran CG and Manktelow ARJ: Periprosthetic fractures around hip hemiarthroplasty performed for hip fracture. *Injury* (2013) 44: 757–762.
- Ryan JC, Duensing IM, Novicoff WM and Browne JA: Are we training surgeons to cement a femoral component in hip arthroplasty? The trainees' perspective. *J Arthroplasty* (2022) 37: S536–S539.
- Quinlan JF, O'Shea K, Doyle F and Brady OH: In-cement technique for revision hip arthroplasty. *J Bone Joint Surg Br* (2006) 88: 730–733.
- Nabors ED, Liebelt R, Mattingly DA and Bierbaum BE: Removal and reinsertion of cemented femoral components during acetabular revision. *J Arthroplasty* (1996) 11: 146–152.