Implant-based reconstruction following mastectomy in patients that have had a previous breast augmentation; lessons from the national multicentre iBRA study.

Authors:

Benjamin G Baker[1], BMBS MRCS MBA, Specialty Registrar

Emma Sewart[2], MBBS, BA(Hons), Junior Clinical Fellow

James Harvey[3,4], FRCSEd, PhD, Consultant Oncoplastic Breast Surgeon

Shelley Potter[2,5], PhD FHEA FRCS, NIHR Clinician Scientist and Consultant Associate Professor in Oncoplastic Breast Surgery

On behalf of the iBRA Steering Group and Breast Reconstruction Research Collaborative*

[1]Department of Plastic Surgery, Manchester University Hospitals NHS Foundation Trust, Wythenshawe Hospital, Manchester, UK, M23 9LT

[2] Bristol Centre for Surgical Research, Population Health Sciences, Bristol Medical School, Canynge Hall, 39 Whatley Road, Clifton, Bristol, UK, BS8 2PS

[3]Nightingale Centre, Manchester University Hospitals NHS Foundation Trust, Wythenshawe Hospital, Manchester, UK, M23 9LT

[4]University of Manchester, Manchester Academic Health Science Centre, 46 Grafton Street, Manchester, UK, M13 9NT

[5] Bristol Breast Care Centre, North Bristol NHS Trust, Southmeand Hospital, Bristol, UK, BS10 5NB

*Members of the iBRA Steering Group and Breast Reconstruction Research Collaborative are PUBMED citable collaborators on this study and are listed below

Corresponding author:

Benjamin Baker

Department of Plastic Surgery, Wythenshawe Hospital, Manchester University Hospitals NHS Foundation Trust, Southmoor Rd, Manchester, M23 9LT, UK.

Email: benjamin.baker@nhs.net

Tel: +44 161 291 6378

Collaborators

The iBRA steering group and members of the Breast Reconstruction Research Collaborative are PUBMED citable collaborators in this study are:

The iBRA Steering Group (in alphabetical order): N L P Barnes, J M Blazeby, O A Branford, E J Conroy, R I Cutress, M D Gardiner, C Holcombe, A Jain, K McEvoy, N Mills, S Mylvaganam, S Potter, J M Skillman, E M Teasdale, S Thrush, Z Tolkien, L J Whisker.

Local investigators (alphabetically by centre) and members of the Breast Reconstruction Research Collaborative are PUBMED citable collaborators in this study and were:

Airedale General Hospital: P Christopoulos, V Fung, C Murphy, L Caldon, H Fatayer, E Baker; **Altnagelvin Area Hospital:** R Johnston; **Ashford and St Peters NHS Trust**: R Newton, A Luangsomboon, B Swiech, A Robinson, M Runkel, **Barts Health NHS Trust:** D Zheng, F Tsang, L Johnson, A Peel, S Ledwidge, S Barker, J Hu, V Voynov, G Exarchos, N Jiwa; **Barnsley Hospital NHS Foundation Trust:** OS Olayinka, JR Dicks; **Basingstoke and North Hampshire Hospital:** V Kalles, K Harris; **Bedford Hospital NHS:** N Manoloudakis, H Charfare, F Conroy; **Belfast City Hospital:** G Dobson, S Sloan, G Irwin, L Darragh, S McIntosh, S Refsum, S Dawson; **Blackpool Teaching Hospital NHS Foundation Trust:** I Michalakis, D Debnath, N Geerthan, P Kiruparan; **Bradford Teaching Hospitals NHS**

Foundation Trust: S Hignett, E Baker, C Tait, R Linforth, M Salab, K Rigby; **Brighton & Sussex University Hospital NHS Trust:** S Shaheed, F Ugolini, R Rathinaezhil, C Zammit, H Osman, A Chouhan; **Castle Hill Hospital, Hull:** A Wilkins, B Wooler, P Kneeshaw, T K Mahapatra, E Khalifa, K Grover, K Hodgkins, S Harrison, P McManus, E Mallidis, J Robinson, F Langlands; **Chesterfield Royal Hospital:** F Mazari, J Massey, I Azmy, C Hollywood; **Countess of Chester Hospital:** W Hamilton-Burke, H Lennon; C Harding-Mackean; **County Durham and Darlington NHS Trust:** T Collin, J Henton; **Craigavon Area Hospital:** G Irwin, P Mallon; **Diana Princess of Wales Hospital, Grimsby:** J Smith, T Masudi, S Joglekar; **Dorset County Hospital:** K Kennedy, T Graja, C Osborne, R. Sutaria, M Youssef, T Stringfellow; **Dunedin Hospital:** B Smith; **East Lancashire Teaching Hospitals**: A.Topps, M Amanita, S Gawne, J McNicholas, C Thomas, M Khanbhai, R Brindle, N Taheri, R Kuruvilla, M Saleh, F Bux, P Pugh, J Iddon; **East Surrey Hospital:** E J Turner, S Waheed; **Frimley Park Hospital:** D Egbeare, J Stevens, E Mallidis, R Daoud, I Karat, I Laidlaw, H Osman, K Kanesalingam, R Johnson, R Gurung; **Glenfield Hospital Leicester:** K Lambert, S Pilgrim, T Rattay, H Khout, D Appleton, B Vijaynagar, S Bains, M Kaushik, J Krupa; **Great Western Hospital, Swindon:** I Dash, A Chaudry, M Galea, N Coombs; **Homerton Hospital:** S Tayeh, S Darvesh, C Choy, L Parvanta; **Kettering General Hospital:** A Knight, M Wright, G Wilson, S Musa; **King George Hospital, Ilford:** S Saha, S Samlalsingh, A Ogedegbe; **Lancashire Teaching Hospitals – Chorley:** A Topps, N Bishop, G Boland. Z Saidan, B Murthy; **Leighton Hospital:** S Hignett, V Pope **; Lincoln County Hospital:** A Sami, A Giaramadze; **Luton and Dunstable University Hospital:** R James, E Stewart-Parker, K Kirkpatrick, D Ravichandran; **Milton Keynes NHS Trust:** A Taylor, K Chin; **Maidstone and Tumbridge Wells NHS Trust:** M Hashem, R Chalmers, H Devalia, K Cox, S Horn, M Dani, D Akolekar, C Chalmers; **Musgrove Park Hospital, Taunton:** S Potter, A Thorne, S Granger; J Gill, U Hassan, C Ives, T Walker, M Chana; **Nevill Hall Hospital:** V Lefemine, F Soliman;

New Cross Hospital, Wolverhampton: T Sircar, F Salem, S Mylvaganam, P Matey, G Nagra, S Marla, R Vidya, N Nuru, I Adwan, E Fage, O Al-Jibury; **North Bristol NHS Trust:** S Potter, I Dash, S Cawthorn, J Cook, S Govindarajulu; **North Middlesex University Hospital:** T Gandamihardja; **Nottingham Breast Unit:** L Brock, M Akerlundh, C Otieno, A Halka, R D Macmillan, K Asgeirsson, L Whisker, H Khout, T Rasheed, C Laban, E Gutteridge, S McCulley; **Oxford:** D Remoundos, PJ Roy; **Peterborough City Hospital:** E Popa, Mr Goh, G Shetty; **Poole General Hospital:** S Clark, A Evans; **Prince Phillip Hospital:** S Udayasankar, S Khawaja, Y Sharaiha; **QE2 Welwyn Garden City**: U Walsh, H Deol; **Royal Berkshire Hospital:** N Dunne, B Smith, A Hakim; **Royal Bolton Hospital:** A Volleamere, C Garnsey, C Wright; **Royal Bournemouth Hospital:** E Skene; C Laban, A Iskender, D Perry; **Royal Devon and Exeter NHS Foundation Trust:** D Egbeare, M Wiltsher, R Johnston, D Ferguson; S Olsen, R Tillett, M Youssef; **Royal Glamorgan Hospital:** S Datta, G Patel, C Steventon, R Foulkes, E Vaughan Williams, G Osborn, C Gateley; **Royal Hampshire County Hospital, Winchester:** N Chand, B Zeidan, D Rainsbury, S Laws. L Peiris, K Harris, V Kalles; **Royal Liverpool and Broadgreen University Hospitals:** A Hargreaves, J Henderson, T Kiernan, N Barnes, M Chandrashekar, A Tansley, C Holcombe, G Mitchell, R Little, S Bathla, M Pennick, E De Sousa, W Hamiton-Burke; **Royal Marsden Hospital:** R Di Micco, R O'Connell, V Voynov, A Parvaiz, A Conway, P Barry, G Gui, J Rusby, N Roche, K Ramsey, K Krupa, L Johnson, D Elfadl, F MacNeil, A Peppe, L Soldanova, I Hamo, P Harris, A Augusti, C Constantinou, A R Godden; **Royal Surrey County Hospital:** E Clayton, A Conway, T Irvine, P Partlett, F Pakzad; **Royal United Hospital Bath:** R Shah, I Dash, S Potter, J Mcintosh, R Sutton, N Laurence; **Royal Victoria Infirmary, Newcastle:** L Darragh, J O'Donoghue, S Nicholson, H Cain, N Collis, J Chatterjee, A Critchley, L Caldon; **St. James's University Hospital, Leeds:** B Kim, D Remoundos, J Massey, R Achuthan, C Fenn, F Mazari, C Navin, K Horgan, S McKenzie, P Turton, M Lansdown; **St George's Hospital:** S Tang, Mr

Banerjee; **St Marys Hospital, Isle of Wight:** M Jobson; **Salisbury District Hospital:** S Masood, V Brown, G Murphy; **Sheffield Teaching Hospitals NHS Trust:** V Fung, N Dunne, L Wyld. S Kohlhardt, V Chandran, L Maraqa, L Caldon, M Reed, A Ismail; **Southampton:** S Robertson, R Cutress ; **Torbay and South Devon NHS Foundation Trust:** C Ives, M Green; **University College Hospital, London:** L Johnson, R Carpenter, J Gattuso, J Franks; **University Hospitals Birmingham:** S Mylvaganam, R Warner, L MacLennan, J Dickson, R Waters, N Basu, S Thomas, S Tadiparthi, S Aggarwal; **University Hospital Coventry and Warwickshire:** A Carbone, J Skillman, T Challoner, S Parker, A Park, A Tomlins, H Khan, E Eltigani, M Kishore, R Nangalia, S Chambers, S Ayaani; **University Hospital Llandough:** C Thomas, R Foulkes, A Hussain, J Iddon, H Sweetland, E Davies, S Tate, S Goyal, A Ghattura, C Zabkiewicz; **University Hospitals North Manchester:** S Narayanan, S Soumian, D Archampong, E Erel; **University Hospitals North Staffordshire:** S Narayanan, S Soumian, V Voynov; **University Hospitals South Manchester:** J Henderson, N Barnes, R Shotton, R Johnson, A Gandhi, J Harvey, C Kirwan, J Murphy, G Byrne, D El Sharief, B Baker, R Chattopadhyay, S Chatterjee, R Irri, Mei Ju Hwang, K Williams; L Barr; **Warrington and Halton Hospitals:** N Sarfraz, P Thawdar; **Warwick Hospital:** M Dakka, H Tafazal, L Jones, D Enver, D Clarke, S Harries; **West Hertfordshire Hospital NHS Trust:** D Cocker, S Monib, L M Lai, S Thomson, K Chong, S Baldota, J Maalo; **Whiston Hospital:** N Barnes, T Kiernan, R Clifford, M Pennick, L Chagla, A Iqbal; **Wirral University Teaching Hospital NHS Foundation Trust:** R Vinayagam, J Lund, M Callaghan, S Poonawalla, K James; **Worcestershire Royal Hospital**: M Tan, R Athwal, M Mullan, S Thrush, R Bright-Thomas, J Taylor, H Tafazal, K McEvoy, M Ahmed; **Yeovil District Hospital:** N Dobner, C Osborne; **York NHS Foundation Trust:** J Piper, E Baker, R Nasr.

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Previous communications

Earlier versions of the analysis were published as an abstract in the European Journal of Surgical Oncology 2020, 46(6):e2: DOI: 10.1016/j.ejso.2020.03.011 (submission to Association of Breast Surgery Conference – cancelled due to COVID-19).

Conflict of interest

There are no conflicts of interest to disclose.

Ethical approval

Ethical approval was not required, as defined by the Health Research Authority decision tool. Local audit approval was obtained for each centre before commencing recruitment to the study.

Short running head: Reconstruction following mastectomy in patients with previous breast augmentation

Abstract

Background

Breast augmentation is the most commonly performed cosmetic procedure, and increasingly women in this group present with breast cancer or request risk-reducing surgery, but their optimal management is unclear. We aimed to explore the clinical and patient-reported outcomes (PROs) of patients undergoing immediate implant-based breast reconstruction (IBBR) following previous augmentation and compare these with outcomes of patients who had not had cosmetic implants in the iBRA study.

Methods

Patients undergoing IBBR were prospectively recruited from breast and plastic surgical units across the UK. Demographic, operative, oncological data, and complications within 3 postoperative months were collected. PROs at 18 months were assessed using the BREAST-Q™. The clinical and PROs of patients undergoing IBBR with and without previous breast augmentation were compared.

Results

2108 women were included in the iBRA study, of whom, 49 had undergone a previous augmentation. Women in the augmentation group were younger (median 45 years, vs 50, p=0.01), had a lower body mass index (22.8 kg/m ^{2} vs 24.9, p<0.01), and had smaller tumours (15mm vs 25mm, p=0.01) than patients without augmentation. No differences were seen in operative technique between the groups. Complications at 3 months were similar in both groups and there were no significant differences in PROs at 18 months.

Conclusions

The clinical and PROs of patients undergoing IBBR following previous augmentation are consistent with those observed in the wider iBRA cohort, supporting the safety of this approach. Work is now needed to compare the outcomes of breast conserving surgery and mastectomy in this group.

Keywords Breast neoplasms; Mastectomy; Breast reconstruction; Breast Implant; Patient reported outcome measures.

Introduction

Breast augmentation is the most commonly performed surgical cosmetic procedure worldwide. In the United States, the number of breast augmentations performed has increased by 41% over the past decade, totalling 299,715 in 2019[1]. Breast augmentation was the most common cosmetic surgical procedure performed in the United Kingdom in 2019, with 7,727 patients recorded in the British Association of Aesthetic Plastic Surgeons national audit[2]. As the numbers of patients having breast augmentation with implants continues to rise and this cohort of patients ages, there will inevitably be an increase in the number of patients in this group that receive a diagnosis of breast cancer, or who are identified as being at high genetic risk and elect to undergo risk-reducing surgery.

The presence of an implant poses several challenges for the oncological and reconstructive surgeon. Breast conserving surgery (BCS) and adjuvant radiotherapy, for example, is the standard of care for the majority of patients with early breast cancer, but women who have undergone augmentation are more likely to have smaller volumes of breast tissue making adequate resection with good cosmetic outcomes potentially challenging. Even if breast conserving surgery is technically feasible, radiotherapy may result in a higher incidence of capsular contracture in patients with implants[3], and the accuracy of ongoing surveillance may be an issue, particularly with subglandular implants[4]. There are few published case-series reporting the outcomes of BCS in this group, but a recent retrospective study of 50 patients from a single European centre has demonstrated that BCS is feasible in patients following augmentation with only seven women (14%) requiring re-excision to clear margins and three (6%) requiring completion mastectomy. Furthermore, at three years, only a third of patients had developed significant (Baker grade 3 or 4) capsular contracture despite receiving radiotherapy[5]. Perhaps most importantly, the study also demonstrated excellent or good

cosmetic outcomes in two-thirds of patients undergoing BCS and radiotherapy post augmentation with high levels of 'satisfaction with outcome' demonstrated using the validated BREAST-Q questionnaire.

As a result of the perceived challenges of breast conserving surgery and radiotherapy in this group, however, many women may opt for mastectomy and reconstruction. Mastectomy and immediate reconstruction following breast augmentation may present specific technical challenges including the potential of thin, poorly vascularised skin flaps and the management of the implant capsule[6]. The optimal approach to reconstruction in this group is unclear. Standard staged reconstruction with a tissue expander followed by a permanent implant can be performed[6], but immediate reconstruction with a fixed volume implant, often facilitated by the use of biological or synthetic mesh, is the most common procedure reported in the European literature[7]. Studies of implant-based reconstruction following augmentation, however, have reported conflicting findings with some authors reporting an acceptable safety profile [8–11], while others highlighted an increased risk of complications in this group of patients[6,12]. These studies, however, were mostly small, and all were single centre and at high risk of bias. Furthermore, they did not evaluate the potential psychosocial impact of altered cosmesis in a group that have already sought cosmetic surgery.

Evidence regarding the safety and outcomes of implant based breast reconstruction in women following augmentation is therefore lacking. The Implant Breast Reconstruction Evaluation Study (iBRA) is a four-phase study that aimed to inform the feasibility, design, and conduct of a future trial in immediate implant based breast reconstruction (IBBR). Phase two, a UK prospective multicentre cohort study, explored the clinical and patient-reported outcomes of different approaches to immediate IBBR with and without mesh[13].

We aimed to explore the clinical and patient-reported outcomes of a UK cohort of patients who underwent IBBR for breast cancer or risk-reduction following a previous augmentation in phase two of the iBRA study and compare these outcomes with patients in the wider iBRA cohort.

Methods

iBRA study design

The iBRA study prospectively recruited consecutive women aged 16 years or older undergoing IBBR for malignancy or risk reduction between 1st Feb 2014 and 30th June 2016[14]. The study protocol was published in 2016[13]. All UK Breast or Plastic Surgery Units performing IBBR were invited to participate via the UK Trainee Collaborative Research Network, the Association of Breast Surgery, and the British Association of Plastic, Reconstructive and Aesthetic Surgeons. There were no restrictions on operative technique and the study included patients undergoing IBBR following nipple, skin-sparing or skin-reducing mastectomy; with standard two-stage and single-stage reconstruction; implant placement in the submuscular or prepectoral plane, and use of biological, synthetic mesh, or dermal sling for lower pole implant coverage. Patients undergoing delayed reconstruction, revisional surgery, or combined procedures, including the use of autologous reconstruction, were excluded.

Patients were identified from outpatient clinics, multidisciplinary team (MDT) meetings, and operating lists. Demographic, operative, oncological data, and complications within 3 postoperative months, were collected by local teams following clinical or case-note review. Anonymised data were recorded using REDCap, a secure online database[15]. Patients were asked to provide written consent to receive patient-reported outcome (PRO) questionnaires at 3 and 18-months following surgery. Where consent was obtained, patient contact details were sent securely to the coordinating center and questionnaires distributed centrally to allow accurate follow-up and minimize missing data[13]. Consenting patients were sent either an electronic or postal questionnaire according to their preference. Reminders were sent after 1 month if no response had been received. Follow-up was complete in December 2017.

Outcomes

Safety was assessed by comparing four key clinical outcomes at 3-months following reconstructive surgery: implant loss (the unplanned removal or loss of the implant as a result of infection or other complication), infection (the presence of a hot, red breast requiring treatment with antibiotics, surgery, or both), readmission (any unplanned readmission to hospital after discharge for any complication of surgery), or re-operation (any return to the operating theatre for a complication within 3 months of the reconstruction procedure).

PROs at 18 months were assessed using the BREAST-Q™ Post-operative Reconstruction module (version 1, Memorial Sloan-Kettering Cancer Centre, NY, USA)[16]. The BREAST-Q has been robustly developed using Rasch methodology for use in the breast reconstruction population[17] and assesses the key PRO domains included in the reconstructive breast surgery core outcomes set[18]. The 18-month questionnaire also included a single-item assessment of overall satisfaction with reconstructive outcome on a five-point Likert scale; excellent, very good, good, fair and poor, as per the 2008/9 UK National Mastectomy and Breast Reconstruction Audit (NMBRA)[19].

Statistical analysis

Women in the iBRA cohort that had undergone a previous breast augmentation were identified from the pre-operative case report forms. Summary statistics were used to describe patient demographics, procedures performed to the breast and axilla, oncological data, 3-month complications and 18-month PROs across the patient groups. Questionnaire responses for the BREAST-Q domains were summed and transformed according to the developers' instructions using the specifically-designed Q-Score software[20]. Scores could range from 0 to 100, with a higher number representing higher levels of patient satisfaction and quality of

life. Comparisons were made between the patients undergoing IBBR following a previous augmentation and the remainder of the iBRA cohort. Two-sided unpaired t-tests were used to test for differences in continuous variable, and chi-squared tests were used for categorical variables. Fisher's exact test was used for categorical variables with two groups when the observed frequency was less than five. A p-value of <0.05 considered statistically significant. The analyses were performed using Stata™ version 10 (StataCorp, College Station, Texas, USA). This study was registered as ISRCTN37664281 and has been reported according to STROBE guidelines[21]. Short-term safety outcomes were published in 2019[14].

Ethical approval and governance

Ethical approval was not required, as determined by the Health Research Authority (HRA) decision tool[22]; each center obtained approval from their local audit department. Patients were approached for written consent to receive questionnaires by members of the clinical team, consistent with the methodology used in the UK National Mastectomy and Breast Reconstruction Audit (NMBRA)[19].

Results

Demographics and neoadjuvant treatment

2108 patients were recruited to the iBRA study, of whom 49 (2.3%) had previously had a breast augmentation. Demographics and neoadjuvant treatments are summarized in Table 1. Women in the augmentation group were significantly younger (median 45 years, interquartile range (IQR) 40-53) compared to the non-augmented group (50, 43-57, p=0.01) and had a lower body mass index (BMI; 22.8 kg/m^2, 20.8-24.6 vs 24.9, 22.3-28.2; p<0.01). There were no significant differences between smoking status or American Society of Anaesthesiologists (ASA) physical classification system grade. Surgery was more likely to be performed for risk reduction rather than malignancy in the augmented group (15, 30.6% vs 396, 19.2%, p<0.05). There was no significant difference in rates of neoadjuvant treatment (Table 1).

Operative approach

In the augmentation group, mastectomy was performed utilising skin-sparing (53.1%) and nipple-sparing (32.7%) techniques, via elliptical nipple-areola incorporating incisions (42.9%), inframammary (18.4%), wise pattern (18.4%), peri-areolar (6.1%), lateral (6.1%), and other (6.1%) incisions, and the proportion of each was not significantly different between groups. Median mastectomy weight was significantly lower in the augmented group (234g, IQR 260-583) than in the non-augmented group (396, 264-587, p<0.001). There were no significant differences in the proportions of patients undergoing one or two stage reconstruction or the types of implant inserted between the groups (Table 2).

Complications within 3 months

There was a trend towards reduced rates of infection in the augmentation group (7, 14.3% vs 515, 25.0%, p=0.08), but this did not reach statistical significance. There was no significant difference in rates of reoperation, readmission, or implant loss between groups (Table 2).

Oncological considerations

Thirty-four patients in the augmented group underwent surgery for breast cancer (Table 3). There was no significant difference in invasive status, grade, or axillary disease between the augmented and non-augmented groups. Tumours, however, were significantly smaller in the augmented group (15mm, IQR 6-18mm vs 25mm, 15-45mm, p=0.01). Planned adjuvant radiotherapy was significantly less likely for patients who had previously undergone a breast augmentation (3, 8.8% vs 509, 30.7%, p=0.01). There was no difference in planned adjuvant chemotherapy or endocrine therapy.

Patient reported outcomes

1470 (69.7%) of patients in the iBRA study consented to receive PRO questionnaires, including 33/49 (67.3%) patients who had previously undergone a breast augmentation. Of these, 891 (60.6%) completed and returned the 18-month PRO questionnaire; 14/33 (42.4%) in the augmented group and 877/1437 (61.0%) in the non-augmented group (Table 4). Women completing the 18 month PRO questionnaires were representative of the cohort of women who had not previously undergone augmentation, but in the augmentation group, responders were older (48 (IQR 42-58) vs 45 (IQR 41-53)), more likely to be non-smokers (12 (85.7%) vs 23 (69.7%)), and less likely to have received neoadjuvant chemotherapy (0 vs 4 (12.1%)) or to had an infection (0 vs 3 (9.1%)) or a complication requiring readmission (0 vs 5 (15.2%)) or re-operation (1 (7.1%) vs 5 (15.2%)) at 3 months following surgery than non-responders (table 5). These differences did not reach statistical significance.

Q scores were higher in the augmented group for satisfaction with breasts (65, 48-78 vs 59, 38-71, p=0.3), satisfaction with outcome (86, 61-100 vs 67, 55-86, p=0.15), sexual well-being (49, 32-77 vs 45.5, 33-60, p=0.85), and physical well-being (81, 68-91 vs 74, 66-85, p=0.2), but lower for psychosocial well-being (63, 43-100 vs 67, 52-86, p=0.85). Satisfaction with overall outcome was excellent or very good in 8 (62%) patients in the augmented group versus 578 (67%) in the non-augmented group. None of these comparisons, however, reached statistical significance (table 4).

Discussion

Key findings & comparison with other studies

This is, to our knowledge, the first prospective study to evaluate the clinical and patient reported outcomes of women undergoing implant-based reconstruction following a previous cosmetic breast augmentation and to compare them with outcomes in patients having IBBR who had not previously received breast implants. Women who underwent IBBR following a breast augmentation were significantly younger, had a lower BMI, and had a lower mastectomy weight than women in the non-augmented group. A range of operative approaches were undertaken in the augmentation group, but these did not differ significantly from the techniques used in patients who had not undergone prior augmentation. Importantly, there were no significant differences in short-term complications, including readmission, reoperation, and implant loss between the two groups. Women treated for breast cancer following previous augmentation had smaller cancers and were less likely receive planned adjuvant radiotherapy than the non-augmented group. There was a suggestion that patients with prior augmentation may report better PROs, particularly satisfaction with breasts, outcome, and physical well-being but the numbers of women included in the study are small and these findings did not reach statistical significance.

Our findings are consistent other published case-series that have reported that women undergoing IBBR following a previous augmentation have a lower BMI [6,8,12], are younger[6], have smaller tumours[23], and lower mastectomy weights[12] than those who have not had previous implant surgery. This is likely to reflect the demographics of women most likely to undergo cosmetic augmentation with the observed lower mastectomy weight due to a combination of smaller breast size driving the pursuit of augmentation, and the impact of the presence of the implant on the surrounding glandular tissue. In this study where all patients

underwent mastectomy, it is notable that the augmented patients had smaller tumours. Further work is needed to explore whether mastectomy was performed due to patient choice, and whether this was the option recommended by the operating surgeon either due to concerns about the aesthetic outcome of breast conserving surgery with smaller volumes of glandular tissue, or to avoid the impact of adjuvant radiotherapy on their pre-existing implants. Previous studies that have suggested that tumours of equal size may be more easily palpated in patients with implants[24,25] may lead us to believe that this cohort may present earlier with symptomatic smaller tumours, but this would not explain why these patients did not undergo breast conserving surgery rather than mastectomy. It is an interesting observation that patients with previous augmentation were not significantly more likely to have a nipple sparing mastectomy, despite the higher proportion of patients undergoing risk reducing mastectomy in this group. It is difficult to draw conclusions regarding the aetiology of this finding without prospective data collection, but this does reflect real world practice in a multi-centre study and warrants further investigation in future studies.

Consistent with previously published studies[8–11], our findings demonstrate that despite the variability in operative techniques, immediate implant based breast reconstruction in patients who have undergone previous augmentation is as safe as in the remainder of the cohort. The thinner skin flaps, which may be attributable both to the lower BMI of the augmented cohort, and due to subcutaneous thinning secondary to the presence of the implant, may be balanced by the prior breast augmentation serving as a delay procedure and increasing the vascularity of the skin envelope by expansion. Our findings are in contrast with Dent et al. who found higher rates of post-operative complications in this cohort in their series reporting nipple sparing mastectomy via an inframammary fold, particularly in patients undergoing single-stage immediate reconstruction[12]. Cho et al. prefer a two-stage approach in their cohort,

noting increased complications in reconstructed patients with prior subglandular augmentation[6]. These findings, and the biology of tissue expansion, suggest that capsule management may be important. It may be that the mastectomy skin flaps in patients undergoing capsulectomy following prior subglandular augmentation are at greater risk of ischaemia compared to mastectomy flaps in patients that have capsule preservation that is more frequent with prior subpectoral augmentation. Further studies are required to elucidate the patient and operative factors that contribute to post-operative complications in this group. This may be particularly important information for women making decisions about risk reducing surgery, and for those considering implants that are likely to require risk reducing surgery later in life.

The PRO Breast Q™ scores compare favourably to the overall iBRA cohort, the published normative scores for implant based reconstruction[26], and those of the National Breast Mastectomy and Reconstruction Audit (NMBRA)[19], in satisfaction with breasts and physical wellbeing domains, but are lower in the psychosocial domain. This may be explained by these patients having had previous experience of implants, and therefore an enhanced understanding, of post-operative sequelae, including the likely post-operative appearances and physical limitations. The lower scores in this group for psychosocial well-being warrants further investigation, and reaffirms expectations that this group is likely to have a different pre-existing psychosocial profile to the cohort of patients undergoing breast reconstruction as a whole. The numbers of patients completing PROs in the study, however, is small and caution is required when interpreting these findings.

Strengths and limitations

This was a large, multicentre, prospective cohort study that used a trainee collaborative model in order to capture as many patients as possible undergoing IBBR. The cohort of augmented patients is large in comparison with others previously published, is the only UK series published to date, and is the first study to capture patient reported outcomes for this group of patients.

The work does have a number of limitations. This study only captures patients that have had immediate implant based reconstruction. Whilst it has previously been reported that this forms the mainstay of reconstruction in these patients[7], this study did not capture those that chose to have autologous reconstruction or breast conserving techniques. It is likely that response bias has impacted the findings, as the proportion of patients that returned the 18-month questionnaire in the augmented group was lower than the overall cohort, and although differences did not reach statistical significance, responders were more likely to be older, and less likely to smoke, have had neoadjuvant chemotherapy, readmission, reoperation, or infection. It is therefore possible that the results observed did not reflect the outcomes of the whole augmentation group. Due to missing data and small numbers of patients in the augmentation group, the analysis was limited. A larger study would be needed to perform risk adjustment and determine what factors, if any, were key determinants of clinical or patient reported outcomes. Complications were only assessed until 3 months. This approach would not capture some important complications, in particular capsular contracture that may have occurred following adjuvant radiotherapy. Finally, PROs will evolve over time and this study only assessed PROs at 18-months in a small number of patients without pre-operative scores for comparison. Whilst this data has suggested some interesting trends, further work should include longer-term follow-up to 5 years, a time period that has recently been agreed as appropriate for IBBR[27].

Conclusions and future work

This is the first UK series reporting the surgical outcomes of patients that have had mastectomy and IBBR following either a diagnosis of breast cancer, or for reduction of breast cancer risk, subsequent to undergoing a cosmetic breast augmentation with implants. It is one of the largest comparative studies in the literature to date for this group, and is the only study to report PROs following mastectomy and breast reconstruction in this cohort. Patients are managed variably, but the safety profile of IBBR in this cohort that was comparable with the remainder of the group. There is a need for future studies to explore the wider management of patients presenting with breast cancer following a cosmetic augmentation, and to compare outcomes between breast conserving techniques and mastectomy with reconstruction in this cohort in order to optimise outcomes and help patients make informed decisions about their reconstructive options.

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Table 1 – Cohort demographics

Table 2 – Operative details and short-term post-operative outcome

Table 3 – Oncological data and multidisciplinary recommendations for adjuvant treatment

Table 4 – 18-month patient reported outcomes

Table 5 – Patients that consented to receive and returned the PRO questionnaire