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### Title

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### Permalink

<https://escholarship.org/uc/item/88h0136c>

### Journal

Contraception, 103(6)

### ISSN

0010-7824

### Authors

Mastey, Namrata  
Matulich, Melissa C  
Uhm, Suji  
[et al.](#)

### Publication Date

2021-06-01

### DOI

10.1016/j.contraception.2021.01.018

Peer reviewed

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BRIEF RESEARCH REPORT

U.S. referral center experience removing nonpalpable and difficult contraceptive implants with  
in-office ultrasonography: a case series

Namrata Mastey, Melissa C. Matulich, Suji Uhm<sup>a</sup>, Courtney C. Baker, Juliana Melo,  
Melissa J. Chen, Mitchell D. Creinin

Department of Obstetrics and Gynecology, University of California, Davis; Sacramento, CA, USA

<sup>a</sup> Current affiliation: Department of Obstetrics, Gynecology and Reproductive Sciences,  
University of Pittsburgh/Magee-Womens Hospital; Pittsburgh, PA, USA

Corresponding Author: Namrata Mastey, MD, MPH; 4860 Y Street, Suite 2500; Sacramento, CA  
95817; [nmastey@ucdavis.edu](mailto:nmastey@ucdavis.edu); 916-734-6670

Conflicts of Interest: Dr. Creinin is a consultant for Merck & Co. The University of California  
Department of Obstetrics and Gynecology receives contraceptive research funding from Merck  
& Co. (Dr. Matulich, principal investigator).

Word Counts:

Abstract: 99 words

Implications Statement: 45 words

Manuscript text (lines 43-133): 1160 words

21 **Abstract**

22 **Objective**

23 To assess referral center outcomes with removal of difficult or nonpalpable contraceptive  
24 implants using high-frequency point-of-care ultrasonography.

25 **Study Design**

26 We present a case series examining patients referred to our specialty center from January 2019  
27 through September 2020 for difficult or nonpalpable implant removal.

28 **Results**

29 Of the 54 referrals, six had palpable implants and 48 required ultrasonography. We localized 46  
30 (96%) implants in-office, including 13 located subfascially; two Implanon® implants could not  
31 be localized. We successfully completed 50 (96%) of 52 attempted in-office removals, including  
32 12 (92%) subfascial implants.

33 **Conclusion**

34 High-frequency point-of-care ultrasonography can effectively localize nonpalpable  
35 contraceptive implants leading to successful in-office removal.

36 **Key Words**

37 Nexplanon; Implanon; etonogestrel; ultrasonography; nonpalpable; contraceptive implant; case  
38 series

39 **Implications**

40 Specialists can use high-frequency POC ultrasonography to localize nonpalpable implants  
41 without formal radiology scans and skilled technologists, optimizing patient time and

42 convenience. However, the probe is expensive, and providers may need to consider this cost in  
43 the context of reimbursement for these highly specialized procedures.

44 **1.0 Introduction**

45 In the U.S., contraceptive implant use has increased from 2.6% in 2014 to 4.3% in 2016  
46 [1]. Fourteen per 1000 removals are reported by providers as difficult (fibrotic tissue, requiring  
47 multiple attempts, migration, or deep position) and 1 per 1000 are nonpalpable [2,3]. For these  
48 difficult to remove implants, some countries, including the United Kingdom, South Africa, and  
49 the U.S., have established referral centers with experts [4-6]. We previously reported our  
50 center's experience for the initial 48 months (January 2015 through December 2018) of our  
51 program [6], using a previously described technique which included sonographic implant  
52 localization in radiology followed by in-office removal through a small (<5 mm) incision [6,7]. In  
53 January 2019, we changed our clinical practice to use point-of-care (POC) ultrasonography with  
54 a 15-MHz linear probe. Only one other case series, from a South African center, details use of  
55 POC ultrasonography for nonpalpable implants; unlike our center, they removed all subfascial  
56 implants with a 1.5-2 cm incision using simultaneous ultrasound guidance [5]. This report aims  
57 to examine our outcomes with implant removal using POC ultrasonography, which has not  
58 been described in the US and may facilitate more efficient implant removal.

59

60 **2.0 Materials and Methods**

61 We present a case series of patients referred to our Family Planning specialty clinic for  
62 difficult or nonpalpable implant removal from January 2019 through September 2020. We used  
63 the same localization and removal technique previously described with a small (<5 mm) incision  
64 for both suprafascial and subfascial implants [6], except we performed localization ourselves in  
65 the office using a 15-MHz probe (Sonosite, Bothell, WA). Fellowship-trained Family Planning

66 specialists or current fellows under their direct supervision performed all removal procedures.  
67 These specialists all received highly focused deep implant removal training during fellowship.

68 We reviewed the electronic medical records of all patients in our implant referral  
69 database during the study period to abstract demographic information, medical histories,  
70 implant-specific data, and clinical outcomes. We chose this time period as it provided the same  
71 number of referrals (n=61) as reported over 48 months in the original series [6]. We primarily  
72 aimed to assess removal outcomes with in-office localization. We used Fisher's exact tests to  
73 compare categorical variables. The UC Davis Institutional Review Board granted exempt status  
74 for this study. This case series has been reported in line with the PROCESS Guideline [8].

75

### 76 **3.0 Results**

77 From January 2019 through September 2020 (21 months), we received 61 referrals; 6  
78 (10%) did not show to their appointment and one could not get insurance authorization for our  
79 clinic. Table 1 presents the demographic, clinical, and procedural characteristics of the 54  
80 patients evaluated during the study period. Twenty-five (46%) of 54 patients evaluated had one  
81 or more removal attempts prior to referral. Eleven (58%) of 19 patients traveling from 50+  
82 miles away had at least one prior removal attempt compared to 14/35 (40%) patients traveling  
83 <50 miles (p=0.33).

84 Six (11%) patients had palpable implants. Forty-six (96%) of the remaining 48 patients  
85 had implants that could be localized with POC ultrasonography. Two patients had Implanon®  
86 devices that neither we nor a radiologist could localize with ultrasonography. One patient, with  
87 her Implanon in place for six years, has been lost to follow-up. The other patient, with her

88 implant in place for 8 years, had chest and arm imaging without implant identification and is  
89 pending etonogestrel serum testing. We attempted removal of the 52 implants localized in the  
90 office. We successfully completed removal for 50 (96%) patients in the office, including 38/39  
91 (97%) suprafascial and 12/13 (92%) subfascial implants. In the failed suprafascial case, the  
92 implant fractured at a crush site from a prior removal attempt during removal of the distal  
93 end, leaving a deeper 1.5 cm fragment. The patient did not desire future fertility and elected to  
94 forgo fragment removal. In the failed subfascial case, the implant was deep in the biceps  
95 muscle and could not be removed despite extensive attempts in clinic; she underwent  
96 successful operating room removal with our collaborative orthopedic surgeon.

97

#### 98 **4.0 Discussion**

99         At our Family Planning specialty referral center, we successfully removed 50 of 52 (96%)  
100 attempted difficult or nonpalpable implants in the office; this success rate is similar to the 92%  
101 rate we reported from January 2015 through December 2018 with implant localization in the  
102 radiology department with a skilled technician and a Family Planning specialist present [6]. The  
103 change to POC ultrasonography did not decrease our ability to localize implants or adversely  
104 affect removal rates.

105         We received the same number of referrals in less than half the time as compared to our  
106 prior report (21 months versus 48 months) [6]. The increased referral rate may result from the  
107 overall increased utilization of the implant in the U.S. over the past decade [1], or it could  
108 reflect increased knowledge of our referral center within the community. The proportion of

109 nonpalpable implants in our more recent cohort (89%) is similar to the prior cohort (87%),  
110 implying that referrals are still occurring primarily for truly difficult removals.

111           Despite the similar proportion of nonpalpable implants, we noticed a decreased  
112 proportion of subfascial implants (24% in this cohort compared to 45% in the prior cohort) [6].  
113 The prior report found a correlation between subfascial implants and non-obese body mass  
114 index [6]. Our current study cohort had a higher proportion of obese patients (43%) compared  
115 to the prior report (27%) which likely explains the lower subfascial implant proportion [6].  
116 Unfortunately, approximately half of the patients are still being referred after one or more prior  
117 removal attempts, which may be related to the rural geographic region that we serve.

118           Prior to having an ultrasound probe in the office, we obtained the patient's history in  
119 clinic, accompanied them to the radiology suite in a different area of the building, marked their  
120 arm during the technologist's scan, and then returned to clinic for consent and removal. Since  
121 obtaining the probe for in-office use, we can perform all of these steps in the same clinic room.  
122 The overall appointment length was not captured in the chart notes so we cannot accurately  
123 assess changes in appointment length and provider time before and after adding the 15 MHz  
124 ultrasound probe. Additionally, we could not report how many of the removals included use of  
125 real-time guidance as this information was not included in the charts. In our experience, POC  
126 ultrasonography saved significant time for our staff, patients, and providers by removing the  
127 need to coordinate appointments with radiology and provided the opportunity for real-time  
128 ultrasound guidance for difficult removals. However, all providers may not find addition of the  
129 probe practical as this new 15 MHz ultrasound probe costs more than \$10,000. Furthermore, as



130 localization and removal was done by providers who received highly focused training in  
131 fellowship, not all providers may have the training necessary to perform these procedures.

132 Overall, the switch to POC ultrasonography maintained highly successful implant  
133 localization and removal in the office while improving clinic flow and patient experience by  
134 eliminating need for a formal radiology scan.

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**Table 1.** Characteristics of patients presenting for removal of difficult or nonpalpable implants after acquisition of an in-office 15 MHz ultrasound probe (N=54).

<b>Patient characteristics</b>	<b>n (%) or mean <math>\pm</math> standard deviation</b>
Age (years)	28.6 $\pm$ 6.8
Race	
White	37 (69)
Black	9 (17)
Native American	1 (2)
Pacific Islander	2 (4)
Unknown/Declined	5 (9)
Hispanic Ethnicity	22 (41)
BMI (kg/m <sup>2</sup> )*	31.9 $\pm$ 10.0
Obese ( $\geq$ 30.0 kg/m <sup>2</sup> )	23 (43)
Parity	
0	30 (56)
1	8 (15)
2+	16 (30)
Referral Clinic	
Reproductive health clinic	28 (52)
Private Office	22 (41)
Academic Office	4 (7)
Distance Traveled (miles)	
Less than 25	25 (46)
25-49	10 (19)
50-99	13 (24)
100 or more	6 (11)
Implant	
Nexplanon <sup>®</sup>	50 (93)
Implanon <sup>®</sup>	3 (6)
Jadelle <sup>®</sup>	1 (2)
Arm	
Left	50 (93)
Prior implant use	18 (33)
Placed through same incision	
Yes	9 (50)
No	6 (33)
Unknown	3 (17)

Imaging before referral	
None	30 (56)
One imaging study (ultrasound or x-ray only)	21 (39)
Multiple imaging modalities	3 (6)
Number of attempts at removal prior to referral	
0	29 (54)
1	19 (35)
2 or more	6 (11)

\* BMI data missing in 5 patients