



## Case series

## Advanced ovarian cancer patients identify opportunities for prehabilitation: A qualitative study

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### ABSTRACT

Prehabilitation may modify frailty and increase resilience in a subset of ovarian cancer patients; however there is low adherence to most programs. Our aim was to investigate potential barriers and facilitators of prehabilitation during neoadjuvant chemotherapy (NACT). We identified 15 patients who underwent NACT from 2016 to 2018. Patients underwent a semi-structured one-on-one interview. Transcripts were coded by 4 independent reviewers to identify emerging themes related to patients' experience, functioning and exercise during chemotherapy. Data saturation occurred after 15 interviews. Patients had a mean age of 64 and were triaged to NACT for unresectable disease in 47% of cases. Patients were overall willing to participate in exercise during chemotherapy, including walking (93%), strength training (87%), and yoga or stretching (33%). Patients identified significant factors which would motivate them to exercise during treatment despite the stated barriers, including perceived benefit to overall health and well-being, improving cancer related outcomes and a supportive treatment community. In addition, the majority of patients cited advice from their physician to participate in an exercise program as highly motivating. Cancer and treatment related symptoms such as fatigue, pain, nausea and vomiting, and respiratory distress, as well as access to care, and social and mental barriers were most often identified by patients as barriers to exercise. Patients with advanced ovarian cancer demonstrated high motivation and willingness to exercise during chemotherapy, particularly when recommended by their healthcare team and when they believe there will be a direct benefit on treatment options or cancer cure.

### 1. Introduction

Patients with epithelial ovarian cancer often present at an advanced stage and primary cytoreductive surgery is attempted in those with resectable disease who are fit for surgery (American Cancer Society, 2020; Hayat et al., 2007; Kumar et al., 2016; Aletti et al., 2011). Given the morbidity and mortality associated with primary surgery, some patients undergo neoadjuvant chemotherapy (NACT) followed by interval cytoreductive surgery (Wright et al., 2008; Eisenhauer et al., 2007; Hightower et al., 1994) NACT is a window of opportunity to mitigate perioperative morbidity in the highest risk groups (Kumar et al., 2017; Morley et al., 2013; Wright et al., 2016).

Increasingly popular in surgical oncologic literature is the concept of prehabilitation (Hijazi et al., 2017; Cabilan et al., 2015; Li et al., 2013; Le Roy et al., 2016; Gillis et al., 2014; Bruns et al., 2016; Banerjee et al., 2013). Prehabilitation strategies aim to improve a patient's fitness before surgery to increase resilience and decrease *peri*-operative morbidity (American College of Surgeons, 2020; Whittle et al., 2018; Carli and Scheede-Bergdahl, 2015; Cabilan et al., 2016). Most prehabilitation strategies, such as The American College of Surgeons

“Strong for Surgery” campaign include a component of exercise to improve muscle strength and endurance (College, 2020). Prehabilitation has been proposed as a strategy to improve patient outcomes in gynecologic oncology. However, there is currently limited data on effective and feasible prehabilitation strategies in ovarian cancer as well as a paucity of data evaluating patient experience and willingness to exercise during treatment (Miralpeix et al., 2019). Examination of patients' perceptions of and experience with physical activity during NACT via qualitative analysis is especially important in determining the feasibility and planning of a prehabilitation intervention.

Our qualitative study sought to understand and evaluate how patients with advanced ovarian cancer undergoing NACT view exercise and physical activity during treatment. We evaluated patient perception in relation to possible barriers, motivators, provider influence and perceived importance. This deeper understanding of exercise willingness in those with increased risk for morbidity is relevant to the continuing advancement of personalized treatment strategies aimed at improving overall outcomes in ovarian cancer. Additionally, these data are essential to design feasible and appropriate prehabilitation strategies.

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<https://doi.org/10.1016/j.gore.2021.100731>

Received 5 January 2021; Received in revised form 9 February 2021; Accepted 13 February 2021

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## 2. Methods

Our study utilized in-depth interviews of patients with advanced (Stage IIIC-IV) ovarian cancer who had undergone NACT. English speaking patients treated between 2016 and 2018 were referred by healthcare providers to the study team for recruitment. Patients were contacted via phone to discuss study participation, were verbally consented and HIPAA sent and returned through the mail. Patients were then interviewed in a one-on-one, semi-structured manner during the same phone call which was subsequently recorded and transcribed. One trained and experienced interviewer with no prior contact with the patient (GA) performed the phone interviews utilizing a framework allowing patients to expand on experiences. Questions were centered on patients' experiences, functioning and exercise during NACT. This qualitative study methodology has been performed previously by these authors and is detailed elsewhere (Coleman et al., 2010; Potrata et al., 2011). Patient recruitment continued until saturation of patient identified themes occurred.

Interview transcripts were read and reviewed by four independent reviewers (AK, CPD, AJ, CLL) who met to create the codebook. The codebook was agreed upon by these reviewers and themes were coded independently to ensure rigor. Patient transcripts were analyzed into themes by two study members (AK and CPD) and subsequently discussed among the full group (AK, CPD, AJ, CLL) to ensure agreement on key themes.

Additional patient characteristics including demographics, disease characteristics, and treatment information were collected via chart review following participant consent. This study was approved by the Mayo Clinic institutional review board. Only patients who could provide informed consent were included in this study.

## 3. Results

Of 17 patients screened, 15 (88%) patients consented to and participated in the study. Interviews were no more than one hour; saturation was reached at 15 patients. Patients had a mean age of 64, were Caucasian (100%), were triaged to NACT for perceived unresectability in 47% of cases, and all patients received platinum based NACT over a total of 6–8 cycles (Table 1). All patients underwent interval debulking surgery with 9 patients (60%) undergoing RDO resection and 6 patients (30%) with < 5 mm residual disease.

### 3.1. Patient experience with physical activity during NACT

Patients reported limited exercise prior to starting chemotherapy, with 73% (11/15) stating they did not take part in structured exercise, though most (87%) reported continued ability to perform activities of daily living (ADLs) (Table 2). One participant reported, "It was never a priority... I would put myself as a zero for physical activity before I was diagnosed (ID1)." Only 27% of patients (4/15) reported regular exercise during NACT, consisting primarily of tasks of daily living and/or regular walking, though some utilized strength training, yoga and stretching.

Though few exercised prior to or during treatment, 93% of patients stated they were willing to participate in structured exercise during treatment. Patients were willing to participate in a variety of exercise including: walking (93%), strength training (87%), and yoga or stretching (33%) during treatment (Table 2). Patients stated they were willing to exercise 3–7 days per week, 15–30 min per day. We further explored patients' experience with and perception of exercise during treatment specifically focused on barriers and motivators (Table 3).

### 3.2. Patient barriers to participate in structured exercise during NACT

Patients noted a variety of barriers to exercise during chemotherapy. These barriers primarily fell into three categories; physical symptoms related to their cancer and/or treatment, access and social barriers to

**Table 1**  
Demographics (n = 15).

Patient characteristic	Value (N = 15 unless specified)
Age (years)	Mean 64.3
BMI (N = 14)	Median 32.35 (Range 22–56)
Albumin at diagnosis	Median 3.6 (Range 2.2–4.8)
Residence	
Urban	10 (67%)
Rural	5 (33%)
Presumed stage at diagnosis	
IIIC	4 (27%)
IV	11 (73%)
ECOG PS at diagnosis	
0	6 (40%)
1	4 (27%)
2	2 (13%)
3	2 (13%)
NR	1 (7%)
Reason for NACT*	
Unresectability	7 (47%)
Albumin ≤ 3.5	6 (40%)
Other (indicate from list)	2 (13%)
Number of cycles NACT	Median 3 (Range 3–7)
Residual disease following surgery	
0	9 (60%)
<5 mm	6 (40%)
Total number of cycles of chemotherapy (N = 11)	Median 6 (Range 6–8)
Status at time of publication	
Alive	13 (87%)
Deceased	1 (6.5%)
NR	1 (6.5%)

NR = Not recorded.

\* PDS attempted in 0 patients

**Table 2**  
Exercise willingness.

	Yes	No
Exercised regularly prior to starting chemotherapy (N = 15)	4 (27%)	11 (73%)
Able to perform ADLs** prior to starting chemotherapy (N = 15)	13 (87%)	2 (13%)
Performed regular exercise during treatment (N = 15)	4 (27%)	11 (73%)
Willing to exercise during treatment (N = 15)	14 (93%)	1 (7%)*
Willing to walk (N = 15)	14 (93%)	1 (7%)*
Willing to strength train (N = 14)	13 (87%)	1 (7%)*
Willing to do yoga/stretching (N = 6)	5 (33%)	1 (7%)*
If provider recommended exercise, would you? (N = 14)	13 (87%)	1 (7%)
Did your provider recommend exercise? (N = 13)	4 (27%)	9 (60%)

\* Represents the same (one) participant.

\*\* Determined by interview response.

exercise, and mental barriers (Table 4).

Most patients identified at least one physical symptom related to their cancer (80%) or cancer treatment (87%) as a barrier for exercise while undergoing treatment. Patients frequently identified fatigue (7/15 patients), difficulty breathing (7/15 patients), and abdominal pain and distension (4/15 patients) as barriers related to their cancer. As several participant detailed, "everything hurt, I had trouble getting my breath. I slept a lot (ID2)," and, "I was just too sick to do much; I could hardly walk (ID5)." Patients also frequently described chemotherapy related symptoms (87%) which limited their physical activity. Patients primarily noted fatigue (9/15) and nausea and vomiting (6/15) as limitations, but several discussed unique treatment related barriers such as neuropathy limiting mobility, bone pain related to G-CSF use and leg pain associated with a DVT.

Patients also described social barriers limiting access to physical

**Table 3**  
Patient identified factors associated with exercise feasibility.

Patient identified barriers to exercise during treatment (N = 15)	N (%)
Cancer symptoms*	12 (80%)
Chemotherapy symptoms**	13 (87%)
Financial	3 (20%)
Location/distance	6 (40%)
Lack of support	4 (27%)
Psychosocial	4 (27%)
Lack of desire/depression	3 (20%)
Patient identified motivators to exercise during treatment (N = 15)	
Overall health	10 (67%)
To fight disease	6 (40%)
To have surgery	7 (47%)
To improve cancer outcomes	9 (60%)
To improve mental health	8 (53%)
If provider recommended exercise	14 (93%)
To be involved in group activities	6 (40%)
Motivated by family/friends	7 (47%)
For symptom control	5 (33%)

\* Cancer related symptoms included: Fatigue, back or abdominal pain, abdominal distension, difficulty breathing.

\*\* Treatment related symptoms included: Fatigue, nausea and vomiting, constipation, neuropathy, pain.

activity during NACT including: location and distance from treatment site, monetary and time barriers, and need to continue working during treatment. One participant discussed the lack of local access; "If they had something close enough... I probably would've taken advantage of it if it had been available"(ID1).

Though less frequently identified, psychosocial barriers to exercise were also described. One patient described her difficulty by stating, "I never went and got groceries or anything for about eight months. I didn't want anyone to see me bald anyway (ID4)." Another patient directly stated, "I just didn't feel good... mentally, it really messed me up (ID12)."

### 3.3. Patient motivation to participate in structured exercise during NACT

Despite the barriers noted above, most patients (93%) were motivated to exercise and remain active during NACT. As one participant stated, "I'm willing to do, whole-heartedly, what will get me better (ID8)." The three main themes which emerged regarding patients' motivation to exercise during treatment were: 1) their perception of improved overall health and well-being, 2) improving cancer related outcomes, and 3) the influence of the oncology care team (Table 4).

Most patients stated they would be motivated to exercise during chemotherapy to improve their overall health (67%) or mental health (53%). One patient described their motivation by stating, "the exercise helps you get the sense that you're contributing to a positive result, that you're doing what you can (ID1)." Another participant summarized their motivations as, "My willingness to live... to beat this, to stay active enough that I could still play with my grandkids (ID6)."

Patients were also significantly motivated to exercise to improve their treatment (40%) or surgical outcomes (47%) and overall cancer prognosis (60%). As one participant stated, "My motivation was [to] beat the cancer... So I was gonna do everything I could to do it (ID11)." Another participant noted, "if it's gonna help you down the line, why wouldn't you do it... people would be more motivated if you were told, *If you walk so much each day, you're gonna have a better outcome* (ID14)." In relation to prognosis, one participant stated, "anything to make my prognosis better, [if] you think making an effort to exercise more is helpful, I'm definitely willing (ID8)."

A frequently-voiced theme emerged around the influence of providers in the motivation to participate in exercise. One stated, "there's nothing to motivate you more than having a doctor sit across from you saying, *This is what you need to do to help yourself*. That was something

**Table 4**  
Emergent themes and representative patient quotes.

Finding	Participant Quotes
<i>Patient experience with physical activity during ovarian cancer treatment</i>	
Physical activity level prior to treatment	"I was never one to do much in terms of exercise... not much physical activity at all (ID8)."  "I couldn't even lift my arms up to wash my hair or even transfer. I was so weak, I-I needed help to transfer into a shower or into a bed (ID7)."  "I really didn't do a whole lot physically because of my long work hours and that. I'm- I'm not a good- I'm not a exercise nut by no means. What-my exercise consists of taking my dog for a walk, working outside, just general everyday things is about it (ID10)."  "Well I'm actually a fitness instructor...[63] I was teaching fitness classes about two to three times a week (I: Okay), cardio, dance, or strength training classes (ID14)."
Physical activity during treatment	"I do take advantage of this two-story house to go up and down the stairs a few times a day because that does make my legs not hurt in the evening, and I sleep much better at night... but that is not much activity (ID8)."  "For me, 30 min was good. So I always felt that if I get at least 30 min, then the box was checked. Sometimes, you know, if we had walked further or we had bicycled out, you know, longer than 30 min, it was still- I thought it was a success (ID1)."  "I could've done 30 min a day... I'd probably do it after work five days a week (ID11)."
Willingness to exercise	"I probably would've walked. I would've tried anything else. If they would've said... <i>this will help you with the pain, or this will help you get better, absolutely</i> (ID12)."  "If it was more like a yoga class or stretching class or like sitting in a chair- legs or strength training...[126] at least starting- especially right after chemo, maybe 10 or 15 and building up to (I: Right) the 30 on the good days... Yeah, I'd certainly try it (ID14)."
<i>Patient barriers to participate in structured exercise during ovarian cancer treatment</i>	
Physical symptoms related to cancer and/or treatment	"I was so sick, and my back and stuff hurt so bad, I could hardly stand to sit in the chair or walk. I was just uncomfortable the whole time (ID2)."  "It would just be really hard to do any type of exercise after receiving chemo... I always felt very tired after receiving it, and I would sleep on the ride home. And then we would get something to eat, and then I'd- I'd sleep again. So I- the day of treatment was usually a hard- hard day to get through (ID1)."  "I guess the difficulties would be the neuropathy in the feet and the hands. That would be my only thing that would pull me back (ID6)."  "I have to do Neupogen shots, and they make my body hurt. I wouldn't exercise when I'm in pain already to begin with (ID10)."  "I was trying to teach my classes, but the pain just got worse and worse and worse, and I went on a leave of absence... I hated not being able to exercise. I was so weak that I just could lay around for some and walk (ID14)."
Access and social barriers	"If medical providers could work with like local exercise locations and get either like discounted memberships or something for cancer patients or

(continued on next page)

Table 4 (continued)

Finding	Participant Quotes
	free memberships while they're on chemo (ID14)."
Mental barriers	"Maybe if they had friends or something that was encouraging them to- you know, to get out and walk or do what- do whatever, that maybe would help (ID2)." "No problems outside of getting your mind set into saying you're gonna do it (ID11)." "When I was on chemo, I had no interest in anything, any friends. I just took naps. People would come to visit. I'd visit but I wouldn't call and initiate any- anything at the time, no interest in anything... I don't know if it was a little depression (ID4)." "Oh, we're talking physically [getting emotional]. I'm about ready to cry now. Mentally, it really messed me up (ID12)."
Patient motivation to participate in structured exercise during ovarian cancer treatment	
Motivation to improve overall and mental health	"My drive to just not let it get me down (ID13)." The fact that I was getting exercise [laughs]. I felt I was, you know, breathing clean air and having my blood circulate a little bit more and yep. There are lots of positives (ID1)."
Motivation related to cancer outcome	"But then I look at myself and I think, <i>Oh well it wasn't till I had cancer</i> [laughs] <i>that it really turned around for me</i> , so I guess everybody has their- their own thing that will, like you said, motivate you to get up (ID1)." "Hey if you walk so much each day, you're gonna have a better outcome, and you're going to get there sooner than if you're just sitting around (ID14)."
Importance of community and providers	"What I believed is to get prepared for the surgery, that it would be an extensive surgery, and so I needed to be in the best physical shape to help with my recovery (ID1)." "That you need to surround yourself with positive people and people that are there to be with you to maybe push you a little bit on the days that you don't wanna be pushed (ID6)." "I did have that (support). Then they would say, <i>Let's go for a walk</i> . Whereas if I was by myself and I was having a pity party that day, I may not have done it (ID1)." "One of the women who does the water aerobics now. She is a breast cancer survivor. And I thought, <i>Well she can do it. I can certainly do it, too</i> . So that's why I'm thinking, <i>Yeah that might be fun to try</i> (ID1)."

that motivated me to get out and exercise (ID1)." Another participant stated, "If the doctor would've told me to do somersaults and I would live, I would have done somersaults [but] nobody really mentioned it (ID4)."

#### 4. Discussion

Patients with advanced ovarian cancer demonstrated high motivation and willingness to exercise during chemotherapy despite notable barriers. Patients discussed a variety of common and specific barriers that may limit uptake or ability to take part in a prehabilitation strategy, but voiced a strong desire to take part in structured exercise when there was a perceived health or wellness benefit, especially if recommended by their healthcare providers. Though treatments for advanced ovarian cancer involve shared patient decision making, there are few aspects

which patients can directly control. A unifying theme to patients' motivation to take part in exercise during treatment is their ability to contribute to a positive outcome in their own cancer outcome. As one patient stated, "one thing you can be proud of is doing everything you can to help yourself and not just give in and wait for the next decision to be made... exercise was a really important part of that for me (ID13)." Despite their desire to improve prognosis, patients are also hesitant to undertake measures not explicitly recommended by their provider. One participant's statement highlights the importance of provider recommendations, noting "if this would be a part of the care team plan, that would make a huge difference because I have to honestly say that you're kind of afraid to do anything because you don't know if it's a good thing (ID13)."

Qualitative studies give us a unique insight into the hardships our patients face as well as their motivation to persevere despite these barriers. In this study, we addressed the need for defining whether patients with advanced ovarian cancer are willing to take part in the structured exercise that would be required in a prehabilitation program. This look into patient perception, barriers and motivation will be important for future studies, and our understanding of the depth of these factors will be critical in implementing prehabilitation strategies as a means of improving outcomes in high risk patients.

This study has limitations. The population sample presented was notably homogeneous in terms of race, ethnicity, language and socioeconomic status. Additional studies evaluating more diverse samples will likely be beneficial in identifying unique needs of subpopulations. The patient population and experience presented is unique in that many patients travel to receive all or some of their care at a large medical center. Though disease and treatment related barriers will be similar, there may be differences in motivators and social barriers associated with traveling for medical care. Despite this, given the depth of patient responses, our results likely have relevance for other large medical centers and may highlight the unique barrier of distance to medical care. Patients were interviewed shortly after completion of treatment and not during treatment, which may affect patient recall of treatment experience. Finally, though qualitative research has inherent limitations in generalizability given the small subset of patient experiences examined, a deliberate framework was utilized throughout this study to capture and review both common and unique themes, improving the overall representation.

In conclusion, this study documented how patients with advanced ovarian cancer undergoing NACT perceive exercise and physical activity in relation to their disease. We found that patients identified significant barriers to participation in structured exercise during treatment, but despite this, were highly motivated to take part when there was a perceived benefit and when recommended by oncology teams. Patients appear to be amenable to prehabilitation during chemotherapy, and a prehabilitation strategy should be designed specifically for the patients with the most potential for benefit and with barriers and motivators in mind.

#### 5. Informed consent statement

All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

#### 6. Research support

The research was supported by the Mayo Clinic SPORE grant (P50 CA136393).

## 7. Previous presentations

This study was previously presented as a poster presentation at the International Conference of frailty and sarcopenia, 2020.

## CRedit authorship contribution statement

**Clarissa Polen-De:** Data curation, Investigation, Writing - original draft. **Carrie Langstraat:** Data curation, Methodology, Supervision, Writing - review & editing. **Gladys B. Asiedu:** Data curation, Methodology, Writing - review & editing. **Aminah Jatoi:** Data curation, Methodology, Supervision, Writing - review & editing. **Amanika Kumar:** Conceptualization, Data curation, Methodology, Supervision, Visualization, Writing - original draft, Writing - review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gore.2021.100731>.

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