2016

Does Aerobic Exercise During Pregnancy Prevent Cesarean Sections?

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A SELECTIVE EVIDENCE-BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
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Philadelphia, Pennsylvania

December 18, 2015

Abstract

OBJECTIVE: The objective of this selective EBM review is to determine whether or not aerobic exercise in pregnant women prevents cesarean sections (“C-sections”).

STUDY DESIGN: Review of two English articles and one English/Portuguese article, two of which were randomized control trials (RCTs) and one was a prospective study, all published after 2011.

DATA SOURCES: Two RCTs and one prospective study found via PubMed and Cochrane Database.

OUTCOMES MEASURED: The main clinical outcome in all studies measured the incidence of C-section as compared to vaginal delivery. The outcomes were measured by method of delivery which was categorized as either vaginally or C-section.

RESULTS: In each study, aerobic exercise was found to be statistically significant in the prevention of C-sections ($p<0.05$). Also, the RRR, ARR, and NNT for each study showed clinical significance to the integration of exercise during pregnancy. Furthermore, aerobic exercise promotes general health in individuals.

CONCLUSIONS: The results of each study show that aerobic exercise to be effective in the prevention of C-sections. However, the limitations of the articles make data extrapolation inconclusive. In order to improve future research, a larger study population and more comparable exercise programs should be implemented.

KEY WORDS: exercise, pregnancy, C-section

INTRODUCTION

A cesarean section (C-section) is a surgical procedure utilized to deliver a child by incising the wall of the mother's abdomen. Though a vaginal delivery is often considered a more natural birth, surgical interventions are often necessary for the health and safety of both mother and child. Unfortunately, this invasive procedure is becoming increasingly common in the U.S. for numerous reasons.

Accounting for 35% of C-sections, the most common indication for surgical delivery is the failure to progress during labor.[1] Typically, labor is progressed by periodic contractions of the uterus which progressively moves the fetus into the birth canal; simultaneously, the cervix ripens and effaces to facilitate the size of the child.[2] When this fails, it is most commonly due to a hypocontractable uterus, maternal obesity, and cephalopelvic disproportion.[2] Occurring in 24% of C-sections, another common indication is a non-reassuring fetal status.[1] During labor and delivery, fetal status is most accurately measured by external or internal fetal heart rate (FHR). Abnormal patterns, fetal bradycardia (FHR < 110 bpm), and late deceleration may be indications for C-section if corrective interventions (suspension of uterotonics, fluids and oxygen administration, and positional change) are ineffective.[3] Accounting for 19% of C-sections, the third most common indication is fetal malpresentation, the most common of which is "breech" which accounts for 3-4% of deliveries.[1,4] As a fetus approaches full term, it will normally position itself into a cephalic presentation with the buttocks near the uterine fundus.[4] However, if this positioning fails, it results in a breech presentation. When maternal or fetal mortality is threatened by this, a C-section may be indicated.

Although C-section delivery may be necessary in some circumstances, the procedure results in other maternal and neonatal morbidities. According to the Center for Disease Control

(CDC), C-sections result in higher rates of maternal transfusion, ruptured uterus, unplanned hysterectomy, and ICU admissions.[5] Additionally, women who undergo emergency C-sections may be at an increased risk for postpartum depression.[6] This surgery can be dangerous for the fetus as well. One study suggests C-sections may increase the risk for respiratory morbidities and fetal laceration.[7] While some data may be inconclusive regarding the precise statistical risks, C-sections cause fear, anxiety, and compromised health in the mother; therefore, the prevention of C-sections is both medically and psychologically desirable.

Despite medical advances and improved prenatal care in the past century, the C-section rate in the U.S. is surprisingly high. The CDC reports the C-section delivery rate was 32.7% of births in 2012 and rose nearly 60% from 1996 to 2009.[8] Additionally, the personnel, supplies, and increased hospital stays due to C-sections result in $7.3 billion in hospital costs annually.[9] Furthermore, C-sections in 2008 with complications and without complication accounted for over 472,000 and 904,000 hospital stays respectively.[9] Therefore, due to the high rate of C-section delivery, physician assistants who care for females of child-bearing age will likely encounter many patients requiring C-sections.

Unfortunately, because labor is unpredictable and different for each woman, few studies offer safe and effective suggestions to prevent C-sections. Some sources suggest that improved and standardized fetal heart rate interpretation and management, increased access to nonmedical interventions during labor, external cephalic version in breech presentation, and a trial of labor in multiple gestations may be effective in prevention.[10] However, the lack of evidence and lack of reliable studies gives providers little to offer patients. Prevention by aerobic exercise is being proposed because of the known benefits to general health, lack of cost, and ease of participation in exercise.

OBJECTIVE

The objective of this selective EBM review is to determine whether or not aerobic exercise in pregnant women prevents C-sections.

METHODS

Specific criteria was selected to conduct the research necessary for this topic. The criteria included healthy, previously sedentary women with uncomplicated and singleton pregnancies who were at least 12 weeks gestation at the beginning of the study. Each study selected used the implementation of a physical conditioning program as the intervention; each study also compared the participants in the physical conditioning program to participants without an exercise regimen. Outcomes were measured by the method of delivery, which was categorized as either vaginal or C-section.

The studies reviewed include two randomized control trials (RCTs) and one prospective study. Each article was published in the English language; one article was also published in Portuguese. The articles were published in peer-reviewed journals found on PubMed or Cochrane databases after 2011. Key words used to find articles included “Cesarean section” and “aerobic exercise.” Articles were selected based on relevance and patient-oriented evidence that matter (POEM) criteria. Each study required patients to be previously sedentary females with viable singleton pregnancies. Maternal age groups and estimated gestational age varied but each required participants under the age of 40 and less than 20 weeks when the study began. Other criteria included a BMI less than 39 $kg*m^{-2}$ in one study. Exclusion criteria included meta-analyses or systematic reviews in Cochrane. Statistics were evaluated using relative risk reduction (RRR), absolute risk reduction (ARR), numbers needed to treat (NNT), p-value, and confidence interval (CI).

Table-1: Demographics & Characteristics of Included Studies

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/ D	Interventions
Barakat[11]	RCT	290	31.4 ±3.2	Healthy women with uncomplicated & singleton pregnancies	Obstetric contraindications to exercise, women not planning to deliver in OB dept. of study hospital, no prenatal care, participation in another physical activity program, high level of pre-gestational physical exercise	30	Physical conditioning program including three 40-45 min. sessions per week, beginning between wks 6-9 until weeks 38-39 of pregnancy.
Price[12]	RCT	62	30.5 ± 5	Viable singleton pregnancy at 12-14 weeks; Body mass index (BMI) less than 39 $kg*m^{-2}$	Aerobic exercise more than once/wk for at least the past 6 mos; Chronic heart or lung disease; Poorly controlled DM, HTN, epilepsy, hyperthyroidism; Severe anemia; Orthopedic limitations; Hx premature delivery, infant delivered SGA, or unexplained fetal death	29	Program of supervised aerobic training of 45-60 min duration, performed 4 times per wk until 36 wks gestation.
Silveira[13]	Prospective Study	66	18-30	Age 18-30; <20 wks gestation at beginning of study; singleton pregnancy; previously sedentary	Pregnant women with clinical /obstetric complications; loss of contact; did not reach min. sessions	31	Physical activity with minimum of 20 sessions of 40 min. of stretching & strengthening

OUTCOMES

All outcomes measured were POEMs. The main clinical outcome in all studies measured the incidence of C-sections. The outcomes were measured by method of delivery which was categorized as either vaginally or C-section. These outcomes were obtained either by patient self-reporting or hospital perinatal records.

RESULTS

All three studies utilized dichotomous data. Each study also used an exercise regimen as the primary and only intervention; though each study differed in the content of the physical conditioning content, each contained an aerobic component.

The first RCT by Barakat et al. used an exercise program as the intervention group (n=138) compared to a sedentary group as a control (n=152) and assessed the method of delivery. This study had inclusion criteria of healthy women with uncomplicated and singleton pregnancies and exclusion criteria as reported in Table-1. The exercise regimen implemented followed the criteria reported in Table-1. During the sessions, each participant also kept a heart rate (HR) under 70% of the age-predicted maximum via HR monitor. The regimen consisted of seven to eight minute warm-up, 25-minute exercises, and seven to eight minutes of cool-down. All sessions were supervised by a fitness specialist. This study addressed exercise implementation and type of delivery, maternal weight gain, and numerous maternal and fetal comorbidities.

There is no specific statement in the Methods, Results, or Conclusion section that addresses whether or not all the participants were analyzed in the group to which they were randomized. For the 30 participants who withdrew or were lost to follow-up, few data are available. Worst-case analysis was not done on these subjects. Although the format of the each study made participant and rater blinding impossible, it is unlikely that this affected outcomes because results were inherently dichotomous data objectively based on method of delivery. Comparison and statistical significance of outcomes measured are shown in Table-2.

Table-2: Comparison and statistical significance of outcomes measured of included studies

Study	CI	P-Value	RRR(%)	ARR (%)	NNT
Barakat[11]	[0.42-0.85]	0.03	-30.9%	-7.1%	(-)1/0.071=-14
Price[12]	N/A	<0.01	-55.6%	-15%	(-)1/0.15=-6
Silveira[13]	N/A	0.031	-47.8%	-29.7%	(-)1/0.297=-3

Results were considered statistically significant for all studies if the p-value was $\leq$0.05. Therefore, the p-value of 0.03 and fairly wide 95% CI intervention is considered statistically significant. The results showed a NNT of (-)14; therefore, for every 14 patients who participate in aerobic exercise during pregnancy, one fewer patient will require a C-section compared to patients who did not participate in aerobic exercise during pregnancy. The ARR showed that participants who participated in aerobic exercise had a 7.1% absolute decrease in C-section. Additionally, the RRR showed that exercise participants have a 30.9% less likely chance of requiring a C-section than the control group. Overall, the incidence of C-section deliveries in the exercise group was 15.9% as opposed to 23% in the control group.[11] Overall, the significant NNT, RRR, and ARR show that exercise can prevent C-sections.

In the second study analyzed in this report, Price et al. enrolled 62 previously sedentary women between the ages of 25 and 35. Thirty-one of these participants were randomly assigned to participate in an exercise regimen as the intervention while the other 31 participants were randomly assigned to a sedentary control group. This study had the inclusion criteria of a viable singleton pregnancy at 12-14 weeks and a BMI less than 39 kg*m^{-2} and exclusion criteria as reported in Table-1. The exercise regimen implemented followed the criteria also reported in Table-1. The exercise sessions were performed at moderate intensity (12-14 on Borg Scale of perceived exertion), consistent with the 2002 exercise guidelines of the American College of Obstetrics and Gynecologists (ACOG). The study addressed exercise implementation and type of delivery, resulting level of fitness, cardiorespiratory fitness, pregnancy complications, and length of postpartum recovery.

Data from all persons who were originally included in the study were analyzed on basis of subjects who completed the study and also by intention-to-treat (analyzing all collected fitness and delivery data whether or not the subject dropped out of the study). For the 32% lost to follow-up, few data are available. Worst-case analysis was not done on these subjects. Table-2 shows the effects of treatment. The intervention is considered statistically significant because the p-value was <0.01. The results showed a NNT of (-)6; therefore, for every six patients who participate in aerobic exercise during pregnancy, one fewer patient will require a C-section compared to patients who did not participate in aerobic exercise during pregnancy. The ARR showed that participants who participated in aerobic exercise had a 15% absolute decrease in C-section. Additionally, the RRR showed that exercise participants have a 55.6% less likely chance of requiring a C-section than the control group. Overall, the incidence of C-section deliveries in the exercise group was 12% as opposed to 27% in the control group.[12] These results demonstrate that exercise can prevent C-sections.

The final study by Silveira, et al. utilized an exercise program for previously sedentary, pregnant females age 18 to 30 as the intervention group (n=37) compared to a sedentary group as a control (n=29) and assess method of delivery. Study participants were also required to be at less than 20 weeks gestation at the beginning of the study. Exclusion criteria and exercise regimen requirements are included in Table-1. The physical activity applied was of medium intensity, using a Borg subjective scale as reference. Participants were instructed to use levels 13 to 14 as limits or when they felt slightly tired as recommended by ACOG. This study addressed exercise implementation and type of delivery and levels of schooling.

There is no specific statement in the Methods, Results, or Conclusion section that addresses whether or not all the participants were analyzed in the group to which they were randomized. For the 32% lost to follow-up, few data are available. Worst-case analysis was not done on these subjects. Comparison and statistical significance of outcomes measured are shown in Table-2. With a p-value of 0.031, the intervention is considered statistically significant. The NNT showed that for every three patients who participate in aerobic exercise during pregnancy, one fewer patient will require a C-section compared to patients who did not participate in aerobic exercise during pregnancy. The ARR showed that participants who participated in aerobic exercise had a 29.7% absolute decrease in C-section. Furthermore, the RRR showed that exercise participants have a 47.8% less likely chance of requiring a C-section than the control group. Overall, the incidence of C-section deliveries in the exercise group was 32.4% as opposed to 62.1% in the control group.[13] Therefore, the p-value, NNT, RRR, and ARR of each study demonstrates that exercise does prevent C-sections.

DISCUSSION

The goal of this systematic review was to determine if implementation of an exercise regimen was a preventative measure against C-section delivery. Each study showed this prevention to be statistically significant. However, the limitations of each study make data extrapolation inconclusive and unreliable.

All three studies contained limitations. Each had a relatively small number of participants that may have inflated the validity of statistical results. In the Barakat et al. study, the exercise regimen had a range of time acceptable to begin participation beginning between six to nine weeks gestation and ending at 38 to 39 weeks gestation. Therefore, the range in amount of time participating in the exercise regimen may have differed up to four weeks in some participants. This was unaccounted for in any calculations. Also, participants' heart rates were kept under 70% of their age-predicted maximum heart rate during exercise; however, because these women were previously sedentary, their target and maximum heart rates may have differed from their expected age-predicted heart rate. Therefore, some of these women may have been over-working during the exercise sessions, making participant safety a potentially dangerous issue while influencing statistical outcome.

In the Price et al. study, though the exercise regimen took place at a convenient location and time for the participants, the authors noted that child-care provision would have increased enrollment, participation, and reliability. Additionally, the study states its main weakness was "difficulty getting all the projected data on all subjects at every data point,"[12] which may have influenced the final NNT. Also, the use of the Borg Scale of perceived exertion for the participants may have introduced subjective data concerning "moderate intensity" exercise.

In the study performed by Silveria et al., subjects were not randomized as it was a prospective study. Authors did this in order to "decrease the bias of the research,"[13] but the lack of randomization likely contributed to the small NNT outcome. Additionally, authors concede that participant withdrawal may have showed a false influence of exercise on the outcome of pregnancy. This lack of participants may have skewed the effects of exercise and given a false

NNT. Also, authors provided little information on the demographics of the study's participants. This, along with the lack of randomization, potentially makes the study results unreliable.

Although these studies fail to provide reliable and conclusive evidence to suggest that exercise will prevent C-sections, the health benefits of proper exercise during pregnancy are vital to general health. Some of the many advantages of exercise include decreased cardiovascular disease, lung disease, kidney disease, diabetes mellitus, and obesity.[14] Additionally, observational studies show that overall mortality risk is decreased in both men and women who exercise regularly.[14] During pregnancy, certain exercises should be avoided for safety purposes. These include contact sports to prevent maternal and fetal trauma and long amounts of time lying supine to prevent inferior vena cava syndrome.[15] However, with correct supervision and medical clearance, pregnant women will greatly benefit from exercise. Furthermore, exercise is cheap and makes insurance coverage of this therapy a non-issue. Therefore, all pregnant woman can objectively benefit from the exercise during gestation.

CONCLUSION

Although the studies reviewed in this report statistically demonstrate that exercise prevents C-sections, analysis of the limitations of each study make conclusions unattainable. Though such limited data cannot definitively determine the significance of exercise on C-section prevention, it does indicate that exercise does not provoke C-sections. For this reason, it is reasonable to encourage pregnant women to continue or begin moderate exercises during pregnancy for general health and fitness.

In order to achieve more reliable results in future studies, several modifications should be implemented. These include a larger participant group, better follow-up for those who discontinue the study, and more comparable exercise schedules, dates, and activities. The most important factor is a larger group of participants. Overall, the studies reviewed were executed well; however, without the corresponding adequate participation, results are skewed. More participants would make results more reliable. However, it may be difficult to convince non-active women to begin exercising after becoming pregnant. Additionally, it may be beneficial to further categorize the experimental group into nulliparous and multiparous as well as previous route of delivery due to the anatomical effects that previous pregnancies may have caused. Potential future studies should also attempt to implement other forms of exercise at differing intensities.

Though a C-section may be medically necessary in some circumstances, it is an invasive procedure that often makes women feel frightened and powerless. As research continues, hopefully studies will be conducted that may show that exercise or other interventions can prevent these surgical procedures and make birth more natural and empowering.

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