Does tagging penguins with metal tags, as opposed to electronic tags, harm them?

Scientists followed 100 penguins, and randomly chose half of them to be tagged with metal tags and half to be tagged with electronic tags. They followed the penguins for 10 years, and found that 10 of the metal-tagged penguins survived, as opposed to 18 of the electronic tagged penguins.

**PART 1: StatKey**

1) Test whether metal-tagged penguins have lower 10 year survival chances than electronically tagged penguins.
   a) State the null and alternative hypotheses.
   b) Create a two-way table of the data.
   c) Calculate the sample difference in proportions, either by hand or in StatKey.
   d) Use StatKey to find the standard error of this statistic.
   e) Use the randomization distribution to find the p-value.
   f) Calculate the z-statistic using $z = (\text{statistic} - \text{null})/\text{SE}$.
   g) Use this z-statistic and the standard normal distribution to find the p-value. (Use the normal distribution part of StatKey).
   h) Do your answers to parts (e) and (g) match? (Hint: they should!)
   i) Make a conclusion in context.
   j) Can we conclude that metal tags (as opposed to electronic) make penguins less likely to survive 10 years? Why or why not?

2) How detrimental is this effect? Give a 90% confidence interval for the difference in proportions...
   a) Using a bootstrap distribution.
b) Using statistic \( \pm z' \times SE \), where you find \( z' \) from a standard normal distribution.

c) Do you answers to parts (a) and (b) match? (Hint: they should!)

d) Interpret your interval in context.

**PART 2: Minitab**

Here we’re going to learn how to do the same thing in Minitab, but with slightly different data. Here we look at the effect of tag type on breeding success. Metal-tagged penguins successfully produced offspring in 32% of the 122 total breeding seasons, while electronically-tagged penguins successfully produced offspring in 44% of the 160 total breeding sessions.

3) Test whether metal-tagged penguins have worse success breeding than electronically tagged penguins, and give a confidence interval for how large this effect is.

a) Stat the null and alternative hypotheses.

b) Create a two-way table of the data.

c) In Minitab, go to STAT -> Basic Statistics -> 2 Proportions, and then in the “2 Proportions” box, use the drop-down menu at the top to change to “Summarized data”. Enter the number of successes and total for each sample in the spaces provided and click on OK. You will get both a p-value and a confidence interval! (Both are calculated using the normal distribution).

b) Interpret your findings in context.