Supplementary S1 Search strategy

PubMed

The search was performed in the “Advanced search” mode.

NanoKnife[tiab] OR Irreversible electroporation*[tiab] OR Reversible electroporation*[tiab] OR ((Non-thermal[tiab] OR Nonthermal[tiab]) AND Ablation[tiab]) OR Electropermeabili*[tiab] OR Pulsed electric field*[tiab] OR Pulsed electrical field*[tiab] OR Pulse electric field*[tiab] OR Pulse electrical field*[tiab]

Web of Science

The search was performed in the “Advanced search” mode. No restrictions were added to the search.

TS = (NanoKnife OR Irreversible electroporation* OR Reversible electroporation* OR ((Non-thermal OR Nonthermal) AND Ablation) OR Electropermeabili*)

Embase

The search was performed in the “Advanced search” mode.

Irreversible electroporation/

OR Irreversible electroporation device/

OR (NanoKnife OR Irreversible electroporation* OR Reversible electroporation* OR ((Non-thermal or nonthermal) AND ablation) OR Electropermeabili* OR Pulsed electric field* OR Pulsed electrical field* OR Pulse electric field* OR Pulse electrical field*).ti,ab,kw).af

IEEE Xplore Digital Library

The search was performed in the “Advanced search” mode for all metadata. No restrictions were added to the search. Electroporation was used as a Mesh term.

“All Metadata”: NanoKnife OR Irreversible electroporation* OR Reversible electroporation* OR ((Non-thermal OR nonthermal) AND ablation) OR Electropermeabili* OR Electroporation OR “Mesh_Terms”: Electroporation

American Society of Mechanical Engineers Digital Collection

The search was performed in the “All Content” mode.

Electroporation

Supplementary S2 Quality assessment

Quality assessment questions

1. Which type of model is used in the study? ** Human patient, *validated model as previously described or frequently used in literature (animal model (in vivo/ ex vivo), tissue phantom, gel, potato)

2. Is a power analysis performed / an adequate sample size present / no overlap in results present? +Yes, - No

3. Are all hypotheses stated in the included study tested? + Yes, - No

4. Is the description of the methods replicable? + Yes, ? Partially, - No

5. Is ethical approval obtained in case of a patient or animal study? + Yes, - No

6. Is the raw data of the ablation zone or temperature measurements available? +Yes, -No

7. Is the statistical method appropriate? + Yes, - No

8. Is the number of observations consistent / is lost to follow-up adequately described? + Yes, - No

9. Are the conclusions justified by the results? +Yes, ? Partially, -No

Additional information per quality assessment section

2. A sample size of $n \geq 10$ is assumed as an adequate sample size. When overlap in data was present between individual experimental groups, for example investigating other combinations of electroporation parameter values, question 2 was answered with No as well. Experimental group results must be sufficiently apart to be able to reliably test the hypothesis.

4. In this section is focused on the methods part of the extracted data included in this review. The method section is considered as replicable when all electroporation parameter settings, equipment and details regarding the timing between the last ablation and sacrifice were reported. As well as an extensive and clear description of the method to determine the ablation zone size and obtain the temperature results. This section is judged as ? in case a detail (e.g., pulse interval between sets of consecutive pulses) is not reported and as – when a few details or a main point (e.g., used generator, method to analysis temperature data or determine the ablation zone size), are not described.

6. Raw data is present when the results are reported of every single experiment. Even when an experiment is repeated five time to investigate the reproducibility of the results. In case the surface or volume of the ablation zone are calculated by a formula, the input values (length/width or height) of the ablation zone should be reported as well. Mean values are not considered as presence of raw data.

7. The statistical method could be regarded as appropriate when in the first place is examined when the data was normally distributed or not. Only based on this assessment could be determined when the right statistical test was used. In almost all articles has not been investigated whether the data was normally distributed. The statistical method was regarded as not appropriate in these cases.

8. The number of observations was considered as inconsistent when the number of animals, gels or potatoes used and/or number of ablations per experimental group were not reported.

Supplementary S3 General information per included study

Table 1. Study characteristics of all included articles. Not applicable (NA). Only the characteristics of the in this review included ablation zone and/or temperature outcomes were described in this table.

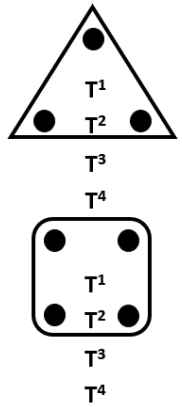
	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
Appelbaum et al. (2014) [1]	Porcine, In vivo	Liver; Not specified	Both not described for the specific experiments included in this review	NanoKnife AngioDynamics; Square	Four monopolar (18 Gauge) electrodes; AngioDynamics	Pulse number	AZ	Gross pathologic examination; 90-120 min after the last IRE ablation	Macroscopic measurements; Perpendicular to electrode insertion path	1D	NA	NA
Ben-David et al. (2012) [2]	Porcine, In vivo	Liver; Throughout the entire liver	Both not described for the specific experiments included in this review	NanoKnife AngioDynamics; Square	Two monopolar (18 Gauge) electrodes; AngioDynamics	Voltage, active needle length, pulse length and pulse number	AZ	Gross pathologic examination; 90-120 min after the last IRE ablation. Liver was sectioned at 3-5 mm interval for ablation zone assessment	Macroscopic measurements; Perpendicular to electrode insertion path	1D	NA	NA
Berkenbrock et al. (2018) [3]	Potato	NA; Potato slice of 20 mm thickness and 40 mm diameter	36 potato slices, 36 AZ	Not specified, Square	Two monopolar needles (Ø 0.6 mm); Manufacturer or custom-made not specified	Voltage	AZ	Macroscopic visualization by photographs of darkened area; 24 hours after ablation	Macroscopic measurements with image processing (thresholding and number of pixels present in the ablated area) in Matlab and the area is measured in ImageJ by color thresholding; Perpendicular to electrode insertion path	2D	NA	NA
Bhonsle et al. (2016) [4]	Perfused Organ Model	POM Liver; Not specified	POM Not described for the specific	BTX ECM 830; Square	Two monopolar (19 Gauge)	Voltage and pulse number	AZ	Gross pathologic examination.	POM Macroscopic measurements;	1D	NA	NA

	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
	(POM, animal not specified), Ex vivo; Canine, In vivo	Canine Liver; Not specified	experiments included in this review; 67 AZ Canine Not described for the specific experiments included in this review; 15 AZ		electrodes; AngioDynamics			POM After 2 hours of additional perfusion after last IRE ablation, TTC stained sections. Canine Harvested 6 hours after IRE ablation, liver sections containing AZ were preserved in 10% buffered formalin for 48 hours before sliced, photographed and analyzed with ImageJ	Perpendicular to electrode insertion path Canine Macroscopic measurements with ImageJ; Perpendicular to electrode insertion path			
Canvasser et al. (2018) [5]	Porcine, In vivo	Kidney; Left upper, left lower, right upper and right lower pole	13 animals; 50 AZ, of which 48 AZ used for size measurements	NanoKnife AngioDynamics; Square	Two monopolar (18 Gauge) electrodes; AngioDynamics	Voltage and active needle length	AZ and T	Gross pathologic examination; 0, 7 or 14 days after IRE	Macroscopic measurements in combination with formula prolate sphere; Perpendicular and parallel to electrode insertion path	3D	Real time temperature monitoring by 4 fiber-optic temperature sensors: 1 at 1.0 cm depth in the middle of both electrodes, sensor 2 and 3 adjacent to electrode 2 and 3 and sensor 4 1.0 cm medial to electrode 1 (peripheral AZ)	Abs

	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
Edelblute et al. (2017) [6]	Mice, In vivo	Pancreas; Pancreatic adenocarcinoma cells injected and grown in left flank mice	Both not described	BTX ECM 830; Square	Four needle electrode array with 5 mm (between anode-anode, cathode-cathode) x 7 mm (between anode-cathode) gaps; Manufacturer or custom-made not specified	Voltage	T	NA	NA	NA	Thermopile temperature sensor using the 4 needle electrodes	Rel
Lee et al. (2013) [7]	Porcine, In vivo	Liver, Location not specified	4 animals; 19 AZ, of which 9 AZ used for size measurements	Prototype IRE generator; Pulse type not specified	Two monopolar (18 Gauge) electrodes; Ethicon Endo-surgery	Inter-electrode distance	AZ	CT imaging and gross pathologic examination (TTC stained for 1 hour and fixed with formalin); CT imaging immediately after IRE and liver harvested 5-6 hours after IRE	3D image analysis software (Vitrea 2) and macroscopic measurements; Perpendicular and parallel to electrode insertion path	1D	NA	NA
Lv et al. (2019) [8]	Potato	NA; Potato slices, electrodes inserted normal to the potato slice surface	Number of used potato slices and AZ not specified	BTX ECM 830; Square	Two monopolar stainless steel electrodes (Ø 1 mm); Manufacturer or custom-made not specified	Pulse number	AZ	Macroscopic visualization by photographs of darkened area; 12 hours after ablation	Ablated area calculated by macroscopic measurements with ImageJ; Perpendicular to electrode insertion path	2D	NA	NA
Neal et al. (2014) [9]	Canine, In vivo	Kidney; Superior, middle or lower lobe	Not described for the specific experiments	BTX ECM 830; Square	Two monopolar (18 Gauge, Ø 1 mm) electrodes;	Voltage	AZ	Gross pathologic examination; Harvested 6	Macroscopic measurements with ImageJ to determine length and width;	1D and 2D	NA	NA

	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
			included in this review; Experiments were repeated at least 4 times per setup → at least 8 AZ		Manufacturer or custom-made not specified			hours after IRE ablation, kidney sections containing AZ were preserved in 10% buffered formalin for 48 hours before sliced, photographed and analyzed with ImageJ	Perpendicular to electrode insertion path			
Ruarus et al. (2018) [10]	Potato; Gel (Polyacryl-amide)	NA; <u>Location potato</u> Not specified <u>Location gel</u> Electrodes placed 5 mm from gel surface	Number of potato and gel experiments not specified	NanoKnife AngioDynamics; Square	Two monopolar electrodes; AngioDynamics	Pulse protocol	T	NA	NA	NA	Two fiber-optic temperature probes (Ø 1 mm), one placed in the middle between both electrodes and the other 5 mm medial from an electrode tip. Temperature measured prior, during and after pulse delivery until returned to baseline	Rel
Scheffer et al. (2016) [11]	Gel (Polyacryl-amide); Porcine, In vivo	<u>Gel</u> NA; Electrodes placed 5 mm from gel surface <u>Porcine</u> Liver, Location not specified	<u>Gel</u> 10; 10 AZ (N = 5 per experiment) <u>Porcine</u> 1 animal; 2 AZ	NanoKnife AngioDynamics; Square	Two monopolar electrodes; AngioDynamics	Pulse number	T	NA	NA	NA	<u>Gel</u> Thermal camera (thermal changes of 0.05 ◦C); Surface around the electrodes, placed 5 mm from the surface <u>Porcine</u> Two fiber-optic temperature probes (Ø 1 mm)	Rel

	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
											placed 0.5 cm medial to both electrodes at equal depth with electrode tips (temperature change of 0.05 ◦C). Liver surface temperature measured by thermal camera (thermal changes of 0.05 ◦C)	
Van den Bos et al. (2015) [12]	Gel (Polyacryl-amide)	NA; Electrodes placed 5 mm ± 1 mm from gel surface. Proximal aspect active tip 4 cm from top surface gel	N = 5 to test average temperature difference and standard deviation for reproducibility. N = 27 to investigate every single parameter variation (N = 1 per variation)	NanoKnife AngioDynamics; Square	Two monopolar (19 Gauge) electrodes; AngioDynamics	Voltage, inter-electrode distance, active needle length, pulse length, pulse protocol and pulse interval	T	NA	NA	NA	Thermal camera (temperature change of 0.05 ◦C); Surface around the electrodes	Abs and Rel
Wagstaff et al. (2014) [13]	Porcine, In vivo	Kidney; Both kidneys, exact location not specified	4 animals; 8 kidneys; 6 AZ (3 per configuration)	NanoKnife AngioDynamics; Square	Three or four monopolar (19 Gauge) electrodes; AngioDynamics	Number of electrodes	T	NA	NA	NA	<u>Tissue surface temperature</u> Thermal camera (temperature changes of 0.05 ◦C) <u>Temperature within tissue</u> 4 fiber-optic temperature probes (T^1-T^4) (temperature	Abs

	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
											changes of 0.05 ◦C)  	
Yao et al. (2017) [14]	Rabbit, In vivo	Liver; Different lobes	Not described for the specific experiments included in this review	Custom-made; Square	Two monopolar stainless steel electrodes (Ø 1 mm) ; Manufacturer or custom-made not specified	Voltage	AZ	Histologic examination; Harvested 72 hours following ablation, fixed in formalin, embedded in paraffin, H&E and imaged	Microscopic measurements, a pathologist depicted the length, width and area of the periphery AZ on H&E stained slices; Perpendicular to electrodes insertion path	1D	NA	NA
Yao et al. (2017) [15]	Rabbit, In vivo	Liver; Different lobes	Not described for the specific experiments included in this review; 3 AZ per experiment (18 AZ)	Custom-made; Square	Two monopolar stainless steel electrodes (Ø 1 mm) ; Manufacturer or custom-made not specified	Voltage	AZ	Gross pathologic examination; Harvested 72 hours following ablation and imaged	ImageJ was used to calculate the ablated area in photographs of fresh liver tissue samples; Perpendicular to electrodes insertion path	2D	NA	NA
Yao et al. (2017) [16]	Potato	NA; Cylindrical potato slice	Experiments were repeated at least 3 times	Custom-made; Square	Four pairs of monopolar	Voltage and pulse number	AZ	Macroscopic visualization by photographs of	Macroscopic measurements with ImageJ and Matlab	2D	NA	NA

	General information						Temperature (T) & Ablation Zone (AZ)					
Author (year)	**Model**	**Organ & Location**	**N (samples, AZ)**	**Generator & Pulse type**	**Electrode type & Manufacturer**	**Varied electroporation parameter settings**	**Focus on T or AZ**	**Visualization AZ & Endpoint**	**Method AZ measurements & Orientation to needles**	**1D/2D /3D AZ**	**Method & Location temperature measurements**	**Absolute (Abs) or Relative (Rel) T**
		with a diameter of 50 mm and height of 6 mm	per experiment → at least 12 potato slices and 12 AZ		stainless steel electrodes (Ø 0.6 mm) ; Manufacturer or custom-made not specified			darkened area; 12 hours after ablation	were used to calculate ablation area; Perpendicular to electrode insertion path			
Zhang et al. (2010) [17]	Rat, In vivo	Liver; Center left lateral lobe	18 animals; 18 AZ	BTX ECM 830; Square	Two monopolar Pt-Ir electrodes (Ø 0.4 mm) ; Manufacturer or custom-made not specified	Voltage	AZ	Imaging (T1-weighted GRE and T2-weighted TSE) and histology (sliced at 3 mm interval and H&E stained); Imaging acquired immediately after IRE, Livers harvested 72 hours following ablation	Imaging Measurements of delineated ablation zones on MR imaging; Perpendicular to electrode insertion path Histology ImageJ was used to delineate and measure the ablation zone; Perpendicular to electrodes insertion path	2D	NA	NA
Zhang et al. (2018) [18]	Potato	NA; Electrodes are inserted along long axis of the potato.	100; 100 (20 different experiments, N=5 per experiment)	Custom-made; Square	Two custom-made monopolar Ni-Ti alloy electrodes (Ø 1 mm)	Pulse protocol, pulse frequency and pulse interval	AZ	Macroscopic visualization, 24 hours after ablation	Macroscopic measurements of darkened AZ in three dimensions (length, width and height) in combination with formula of ellipsoid; Perpendicular to electrode insertion path	1D and 3D	NA	NA

Supplementary S4 Electroporation parameter values per included study

Table 2. Electroporation parameter values per included study. Only the electroporation characteristics of the in this review included ablation zone and/or temperature outcomes were described in this table.

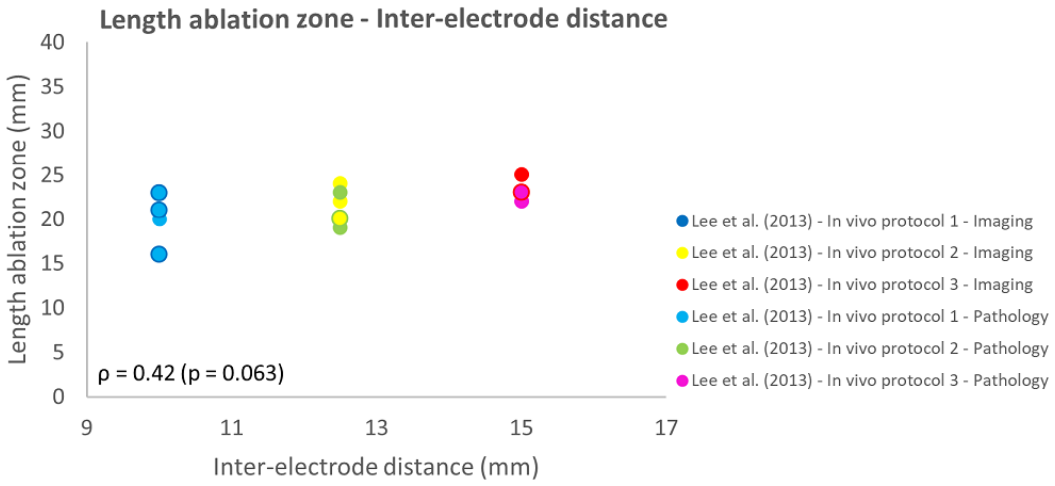
Author (year)	Parameters varied in study	Number of electrodes	IED (mm)	ANL (mm)	Voltage (V)	Pulse length (µs)	Pulse number	Pulse protocol	Pulse frequency	Pulse interval (s)	Particularities
Appelbaum et al. (2014) [1]	Pulse number	4 (Square configuration)	25	20	3000	100	Multiple sets of 20 pulses per electrode pair were delivered. 80, 120, 160 and 200	4 x 20 6 x 20 8 x 20 10 x 20	ECG gated pulse delivery		
Ben-David et al. (2012) [2]	Voltage, active needle length, pulse length and pulse number	2	15	10, 20 and 30	2250	20, 50, 70, 90 and 100	20, 50, 70 and 90		ECG gated pulse delivery		
Berkenbrock et al. (2018) [3]	Voltage	2	3	5	210 – 390 with 60 V interval	100	8	1 x 8	1 pulse/s		
Bhonsle et al. (2016) [4]	Voltage and pulse number	2	15	<u>POM</u> 10 and 20 <u>In vivo</u> 10	<u>POM</u> 1875, 2250, 2625, 2650 and 3000 <u>In vivo</u> 1875 and 2625	<u>POM</u> 70 and 100 <u>In vivo</u> 100	<u>POM</u> 50, 70, 90, 100, 150, 200, 300, 400 and 600 <u>In vivo</u> 50, 100, 200 and 400		1 pulse/s		<u>In vivo</u> Polarity reversed every 50 pulses. After pulse 10 and 50 a 5s pause to store the data
Canvasser et al. (2018) [5]	Voltage and active needle length	2	15	10 and 15	1500, 2250 and 3000	100	140	70-70	ECG gated pulse delivery		70 straight pulses followed by 70 pulses of reversed polarity
Edelblute et al. (2017) [6]	Voltage	4	7	3	1400 and 1750	100	90		1 pulse/s		7 mm gap between the anode and cathode, each 2 electrodes. 5 mm gap between electrodes of the same polarity. Electrodes of the same polarity in a straight line on the same side

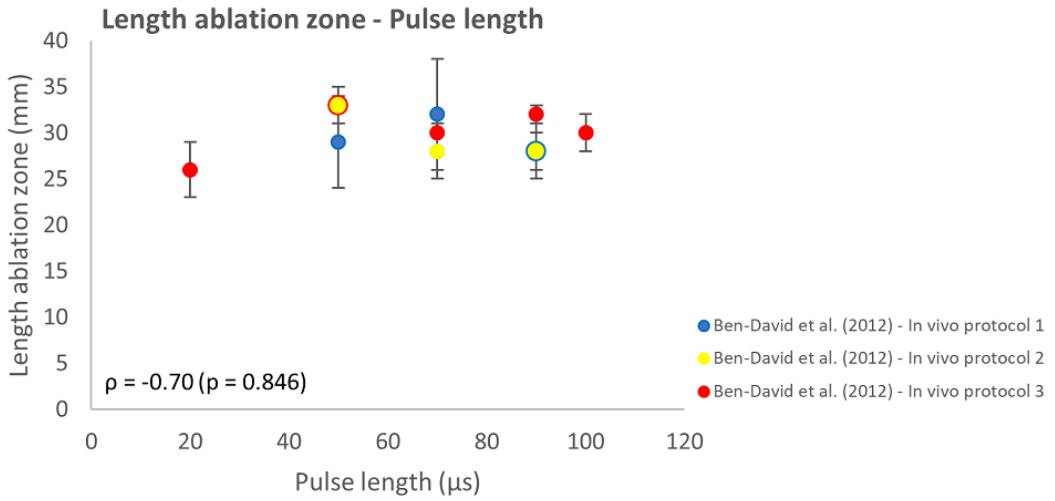
Author (year)	Parameters varied in study	Number of electrodes	IED (mm)	ANL (mm)	Voltage (V)	Pulse length (µs)	Pulse number	Pulse protocol	Pulse frequency	Pulse interval (s)	Particularities
Lee et al. (2013) [7]	Inter-electrode distance	2	10 - 17.5 with 2.5 mm interval	20	3000	10	60	6 x 10			
Lv et al. (2019) [8]	Pulse number	2	5	5	500	100	10 and 50		1 pulse/s		
Neal (2014) [9]	Voltage	2	10	10	1250 and 1750 50 V pre-pulse	100	100 (excluding 1 pre-pulse)	1-100	1 pulse/s	5 s pause after pulse 10 and 50 to store the data	Polarity reversed after 50 pulses
Ruarus et al. (2018) [10]	Pulse protocol	2	20	20	2000	90	100 Protocol was repeated after a cool-down period	10-90 10-30-30-30 Protocol was repeated after a cool-down period			
Scheffer et al. (2016) [11]	Pulse number	2	15	15	<u>Gel</u> 1500 <u>In vivo</u> 2250	90	90 and 270	1 x 90 3 x 90	90 pulses/min		
Van den Bos et al. (2015) [12]	Voltage, inter-electrode distance, active needle length, pulse length, pulse protocol and pulse interval	2	5 - 30 with 5 mm interval	5 - 25 with 5 mm interval	500 – 2500 with 500 V interval	50, 70 and 90	90 and 120	1 x 90 2 x 60 4 x 30 6 x 20	90 pulses/min	30, 60 and 90	
Wagstaff et al. (2014) [13]	Number of electrodes	3 and 4	15	15	2250	90	70 pulses per electrode pair	<u>3 needle configuration</u> 3 x 70 for all electrode pairs and 1 x 70 per single pair <u>4 needle configuration</u> 6 x 70 for all electrode pairs and 1 x 70 per single pair	90 pulses/min		

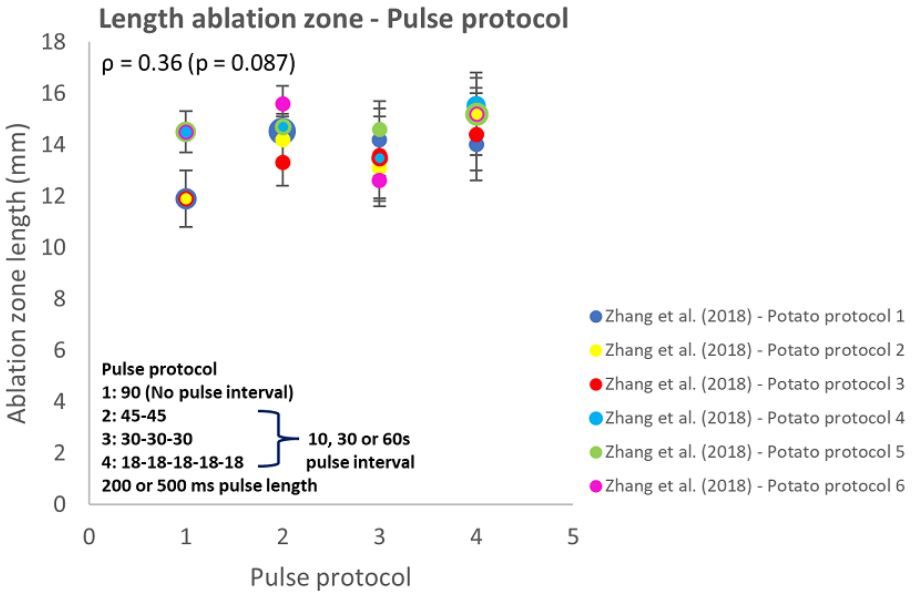
Author (year)	Parameters varied in study	Number of electrodes	IED (mm)	ANL (mm)	Voltage (V)	Pulse length (µs)	Pulse number	Pulse protocol	Pulse frequency	Pulse interval (s)	Particularities
Yao et al. (2017) [14]	Voltage	2	4	8	240, 360 and 480	100	60 and 80		1 pulse/s		
Yao et al. (2017) [15]	Voltage	2	10	8	800, 1000, 1250 and 1500	100	90		1 pulse/s		
Yao et al. (2017) [16]	Voltage and pulse number	8 (4 pairs)	2.5	6	150, 200 and 250	100	60 and 80		1 pulse/s		Four pairs of electrodes. 2.5 mm between the anode and cathode, each 4 electrodes. 2 mm between electrodes of the same polarity. Electrodes of the same polarity in a straight line on the same side.
Zhang et al. (2010) [17]	Voltage	2	10	12	1000, 1500 and 2500	100	8	1 x 8	1 pulse/100 ms		
Zhang et al. (2018) [18]	Pulse protocol, pulse frequency and pulse interval	2	5	5	1000	90	90	1 x 90 2 x 45 3 x 30 5 x 18	1 pulse/200 ms 1 pulse/550 ms	0, 10, 30 and 60	

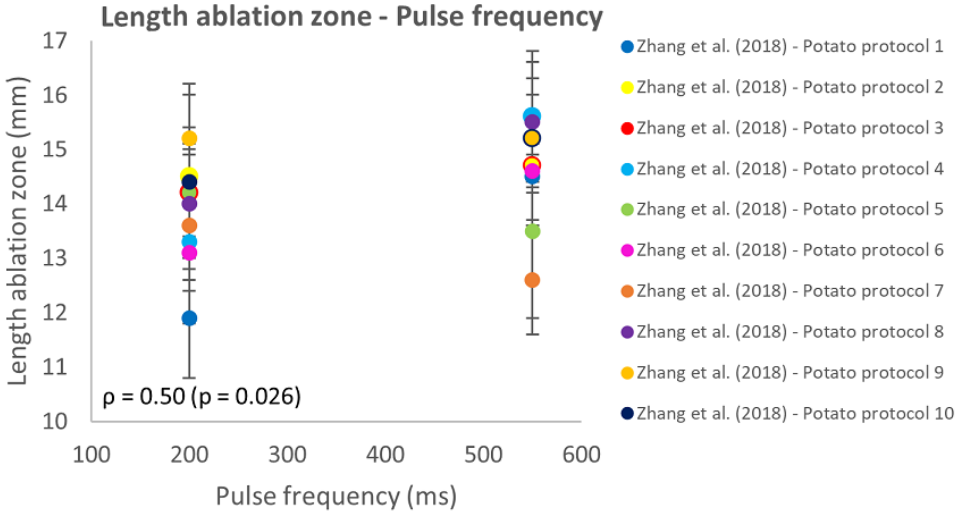
Supplementary S5 **Additional graphical representations ablation zone per electroporation parameter – not included in the main article**

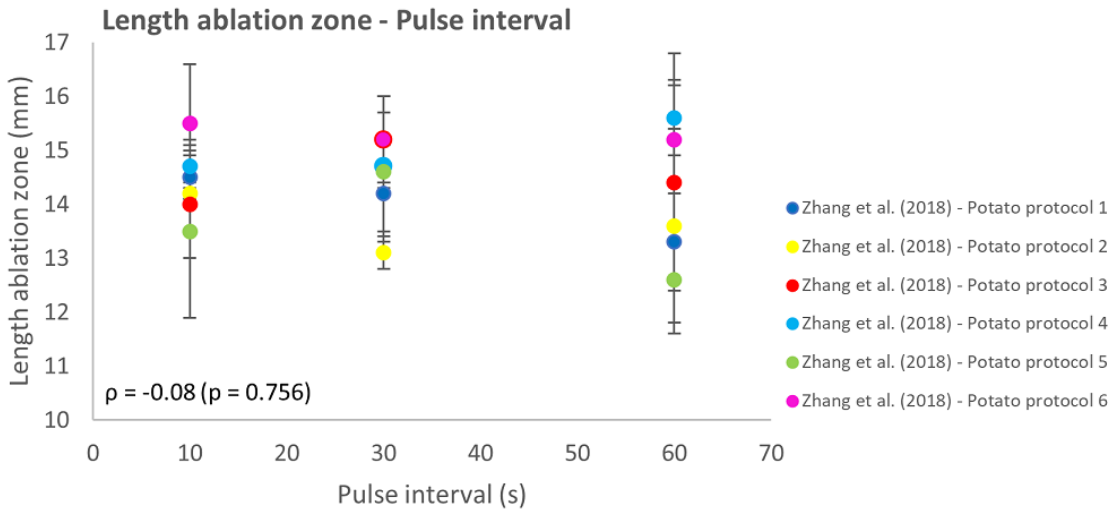
Length ablation zone



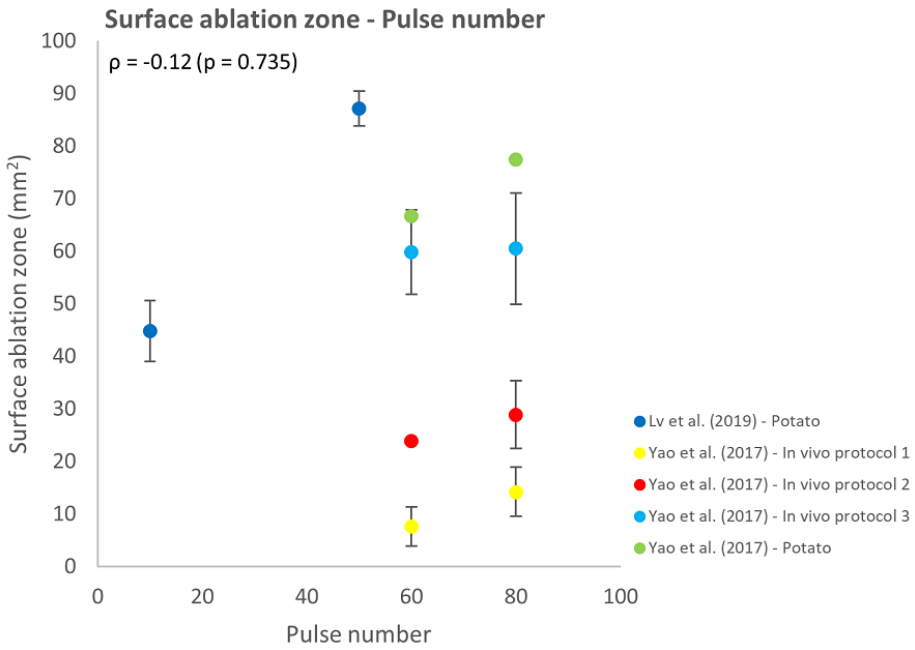



Length ablation zone - Pulse protocol
ρ = 0.36 (p = 0.087)
Ablation zone length (mm)
Pulse protocol
Pulse protocol
1: 90 (No pulse interval)
2: 45-45
3: 30-30-30
4: 18-18-18-18-18
10, 30 or 60s pulse interval
200 or 500 ms pulse length
Zhang et al. (2018) - Potato protocol 1
Zhang et al. (2018) - Potato protocol 2
Zhang et al. (2018) - Potato protocol 3
Zhang et al. (2018) - Potato protocol 4
Zhang et al. (2018) - Potato protocol 5
Zhang et al. (2018) - Potato protocol 6

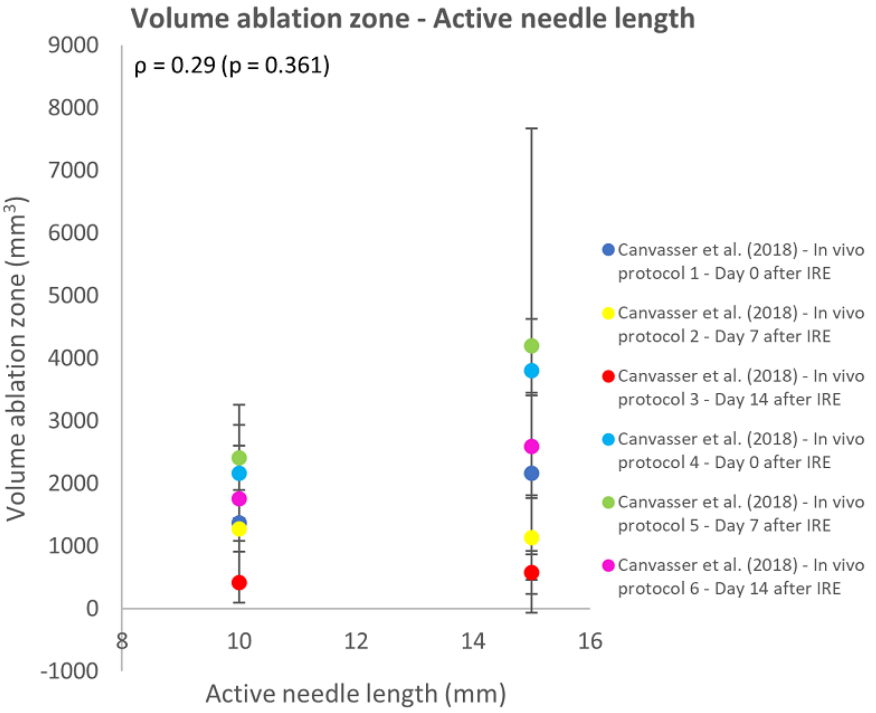

Length ablation zone - Pulse frequency
Length ablation zone (mm)
ρ = 0.50 (p = 0.026)
Pulse frequency (ms)
Zhang et al. (2018) - Potato protocol 1
Zhang et al. (2018) - Potato protocol 2
Zhang et al. (2018) - Potato protocol 3
Zhang et al. (2018) - Potato protocol 4
Zhang et al. (2018) - Potato protocol 5
Zhang et al. (2018) - Potato protocol 6
Zhang et al. (2018) - Potato protocol 7
Zhang et al. (2018) - Potato protocol 8
Zhang et al. (2018) - Potato protocol 9
Zhang et al. (2018) - Potato protocol 10

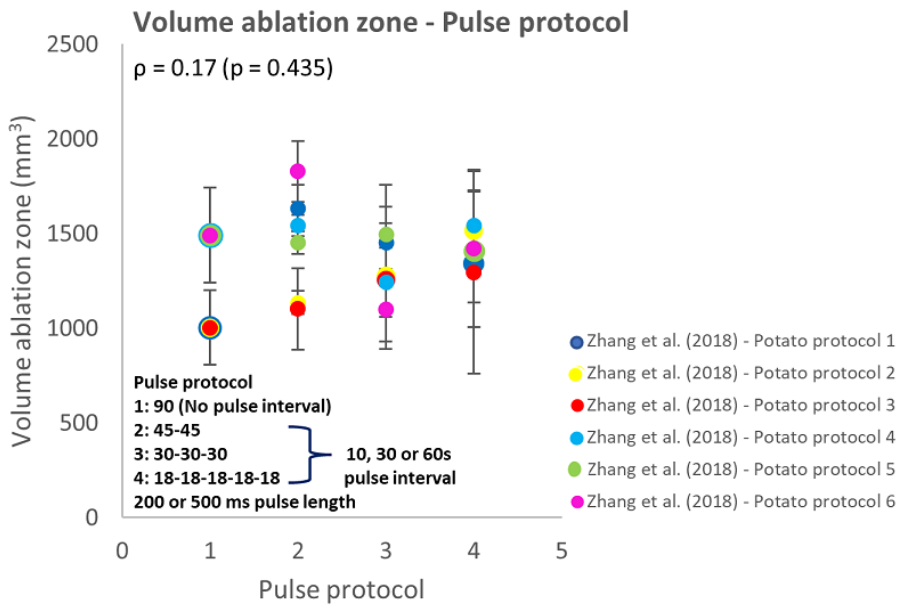

Length ablation zone - Pulse interval
Length ablation zone (mm)
ρ = -0.08 (p = 0.756)
Pulse interval (s)
Zhang et al. (2018) - Potato protocol 1
Zhang et al. (2018) - Potato protocol 2
Zhang et al. (2018) - Potato protocol 3
Zhang et al. (2018) - Potato protocol 4
Zhang et al. (2018) - Potato protocol 5
Zhang et al. (2018) - Potato protocol 6

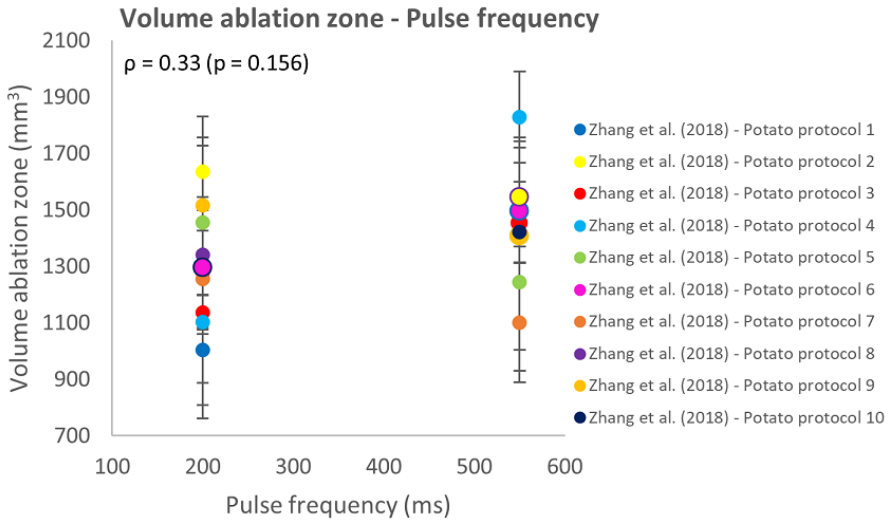
Surface ablation zone

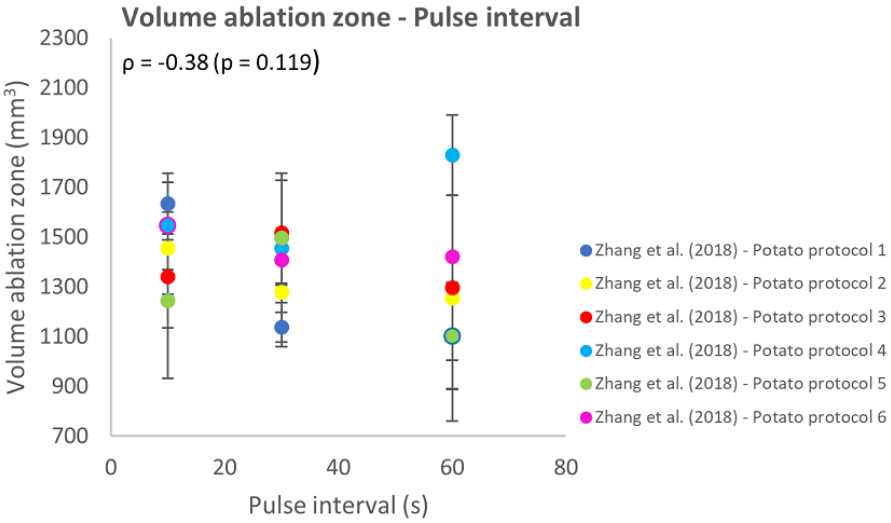


Volume ablation zone

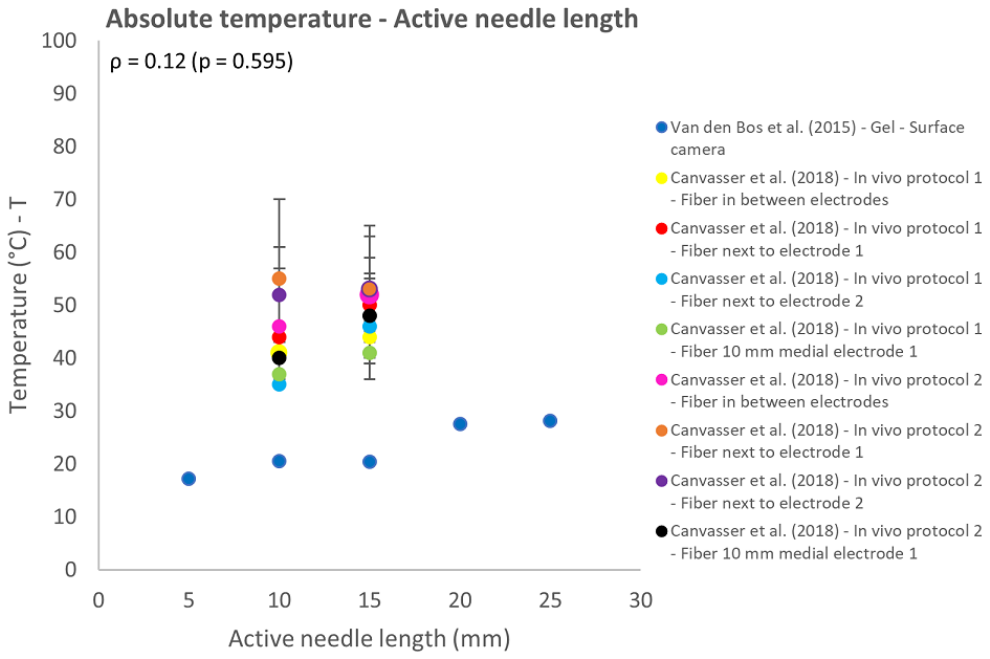


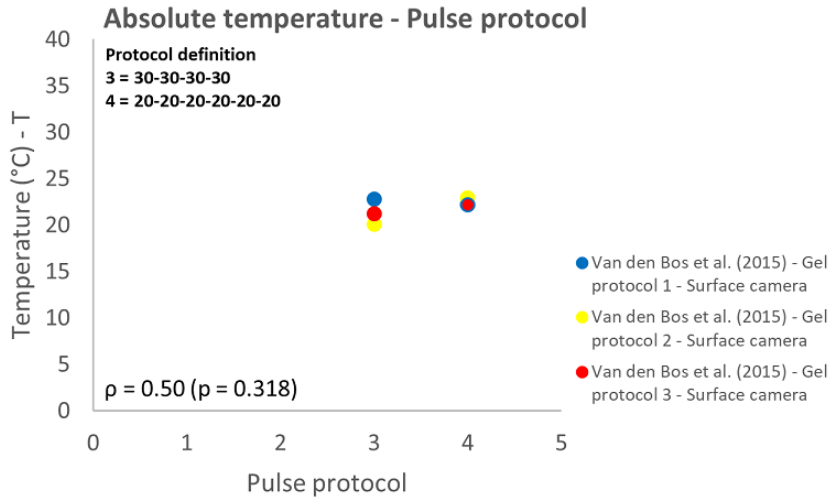

Volume ablation zone - Pulse protocol
ρ = 0.17 (p = 0.435)
Volume ablation zone (mm³)
2500
2000
1500
1000
500
0
0
1
2
3
4
5
Pulse protocol
Pulse protocol
1: 90 (No pulse interval)
2: 45-45
3: 30-30-30
4: 18-18-18-18-18
200 or 500 ms pulse length
10, 30 or 60s
pulse interval
Zhang et al. (2018) - Potato protocol 1
Zhang et al. (2018) - Potato protocol 2
Zhang et al. (2018) - Potato protocol 3
Zhang et al. (2018) - Potato protocol 4
Zhang et al. (2018) - Potato protocol 5
Zhang et al. (2018) - Potato protocol 6

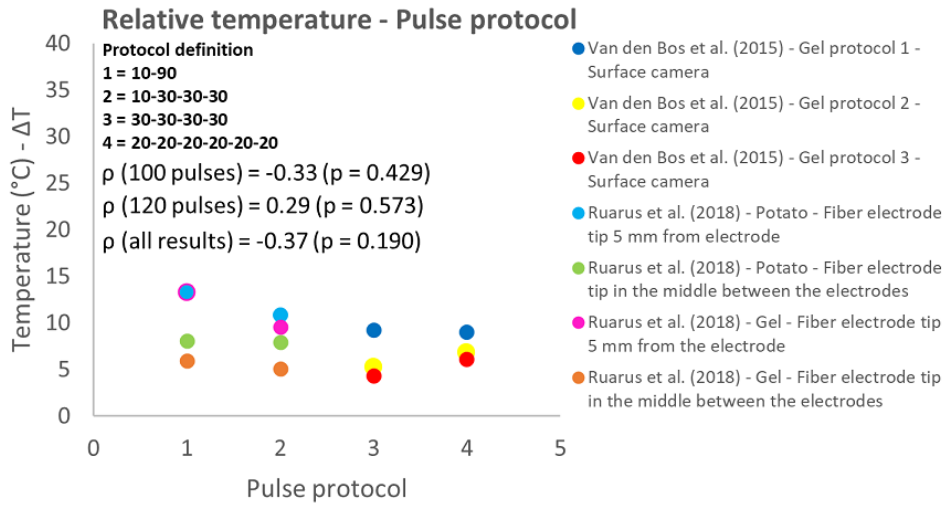

Volume ablation zone - Pulse frequency
ρ = 0.33 (p = 0.156)
Volume ablation zone (mm³)
2100
1900
1700
1500
1300
1100
900
700
100
200
300
400
500
600
Pulse frequency (ms)
Zhang et al. (2018) - Potato protocol 1
Zhang et al. (2018) - Potato protocol 2
Zhang et al. (2018) - Potato protocol 3
Zhang et al. (2018) - Potato protocol 4
Zhang et al. (2018) - Potato protocol 5
Zhang et al. (2018) - Potato protocol 6
Zhang et al. (2018) - Potato protocol 7
Zhang et al. (2018) - Potato protocol 8
Zhang et al. (2018) - Potato protocol 9
Zhang et al. (2018) - Potato protocol 10


Volume ablation zone - Pulse interval
ρ = -0.38 (p = 0.119)
Volume ablation zone (mm³)
2300
2100
1900
1700
1500
1300
1100
900
700
0
20
40
60
80
Pulse interval (s)
Zhang et al. (2018) - Potato protocol 1
Zhang et al. (2018) - Potato protocol 2
Zhang et al. (2018) - Potato protocol 3
Zhang et al. (2018) - Potato protocol 4
Zhang et al. (2018) - Potato protocol 5
Zhang et al. (2018) - Potato protocol 6

Supplementary S6 **Additional graphical representations temperature effects per electroporation parameter – not included in the main article**







Supplementary S7 **PRISMA checklist**

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	YES
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	YES
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	YES
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	YES
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	YES
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	YES
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	YES
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	YES
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	YES
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	YES
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	YES
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	YES
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	YES
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	YES
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	YES
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	YES
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	YES
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	YES
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	YES

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	YES
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	YES
Study characteristics	17	Cite each included study and present its characteristics.	YES
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	YES
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	YES
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	YES
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	YES
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	YES
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	YES
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	YES
	23b	Discuss any limitations of the evidence included in the review.	YES
	23c	Discuss any limitations of the review processes used.	YES
	23d	Discuss implications of the results for practice, policy, and future research.	YES
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	YES
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	YES
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	YES
Competing interests	26	Declare any competing interests of review authors.	YES
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	YES

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Supplementary S8 **PRISMA abstract checklist**

PRISMA 2020 for Abstracts Checklist

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	YES
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	YES
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	YES
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	YES
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	YES
Synthesis of results	6	Specify the methods used to present and synthesise results.	YES
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	YES
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	YES
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	YES
Interpretation	10	Provide a general interpretation of the results and important implications.	YES
OTHER			
Funding	11	Specify the primary source of funding for the review.	YES
Registration	12	Provide the register name and registration number.	YES/YES

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

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