Parp1-Xrcc1 and the repair of DNA double strand breaks in male germ cells and Sertoli cells

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In male germ cells the repair of DNA double strand breaks (DSBs) differs from that described for somatic cell lines due to differences in the expression or even the absence of some DNA repair proteins in particular germ cells. For example, Ku70 is not expressed in early spermatocytes, DNA-PKcs is absent in spermatids, and 53bp1 and mdc1 are differentially expressed. Besides their role in base excision repair and single strand repair, Parp1 and Xrcc1, together with DNA ligase 3, were reported to be involved in the repair of DNA DSB in the absence of the Ku proteins. We now have studied the expression Xrcc1 and Parp1 in the irradiated and non irradiated mouse testis. Xrcc1 and Parp1 are highly expressed in spermatogonia, which also express other DNA repair proteins but not Mdc1. In these cells Xrcc1 and Parp1 may provide an additional repair pathway. In spermatocytes, Xrcc1 was found on the axial elements and sex chromosomes and in late spermatocytes after irradiation it formed foci that did not overlap with γ-H2AX foci. Round spermatids expressed both Parp1 and Xrcc1. We previously showed that in round spermatids DNA DSB repair does take place. However, in these haploid cells homologous recombination is not possible, and DNA-PKcs is not expressed making classical non-homologous end joining (NHEJ) impossible. In round spermatids the Xrcc1/Parp1 dependent repair pathway may be responsible for the observed DNA DSB repair. Finally, both Xrcc1 and Parp1 are expressed in early elongating spermatids and are probably involved in the extensive chromatin remodeling in these cells. In contrast to other testicular somatic cells, Sertoli cells were positive for Xrcc1 and Parp1, before and after IR. Sertoli cells were reported to express ku70, ku86 and p53 already before irradiation and pAtm in response to irradiation. Furthermore, after irradiation, 53BP1 foci are formed in Sertoli cells that diminish with time (Ahmed et al 2007, DNA Repair). Using the comet assay we now show that Sertoli cells can repair irradiation induced DNA damage. Taking together, Sertoli cells do not behave as normal terminally differentiated somatic cells, in that they are still able to repair DSBs. In conclusion, NHEJ repair of DNA DSBs via the Parp1/Xrcc1 pathway may occur in germ cells and Sertoli cells when homologous recombination is not possible and/or one of the main components of classical NHEJ is absent.

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